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COMPUTER PROGRAM FOR POST-FLIGHT ANALYSIS OF RIGID BODY MOMENTS ACTING ON A LAUNCH VEHICLE FIRST STAGE

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COMPUTER PROGRAM FOR POST-FLIGHT ANALYSIS OF RIGID BODY MOMENTS ACTING ON A LAUNCH VEHICLE FIRST STAGE

SUMMARY

This report describes a FORTRAN coded computer program and method for evaluation of the rigid body disturbing moments for a launch vehicle first stage based on post-flight measurements. The technique is a straightforward deterministic approach. Residual moments are computed to satisfy the equations of motion. Residuals are expressed also in terms of altered vehicle characteristics; i.e., aerodynamic coefficients, thrust misalignment, and control effectiveness. This method has been used on the Scout Launch Vehicle for more than fifteen years and has uncovered several significant differences between flight data and wind tunnel data.

The computer program is written in FORTRAN IV for a CDC CYBER 173 computer system. It has been used on IBM 7090, IBM 360/370 and CDC 6600 computer systems with minor modifications. A typical problem requires less than 20 seconds of running time on a CDC CYBER 173 computer system. The program and associated subroutines contain 1745 cards and requires (38K) words of memory.

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LIST OF SYMBOLS

		Units
a_i	polynomial coefficients	—
C_{L_ϵ}	aerodynamic lift coefficient per degree fin misalignment	1/deg
C_l	aerodynamic rolling moment coefficient	—
C_{l_ϵ}	aerodynamic rolling moment coefficient per degree of fixed fin misalignment	1/deg
C_{l_p}	aerodynamic roll damping derivative coefficient	1/deg
C_m	aerodynamic pitching moment coefficient	—
C_{mq}	aerodynamic coefficient of pitch damping derivative due to pitch rate	1/deg
C_N	aerodynamic normal force coefficient	—
C_{N_α}	aerodynamic normal force coefficient per degree angle of attack	1/deg
C_{N_δ}	aerodynamic control normal force coefficient per degree deflection	1/deg
C_n	aerodynamic yawing moment coefficient	—
D	aerodynamic drag force	lbs
d	aerodynamic reference length	ft
F	control force	lbs
F_{r_δ}	rocket booster control force per degree deflection	lbs/deg
h	altitude	kilofeet
I	mass moment of inertia	slug-ft^2
I_{sp}	rocket booster specific impulse	lb-sec/lb$_m$
K_{JD}	rocket booster jet damping coefficient	ft-lb-sec/deg
K_α	coefficient of thrust misalignment induced by aerodynamic lift loads	ft^2/lb-deg
K_δ	coefficient of thrust misalignment induced by control forces	1/lb-deg
L	roll moment	ft-lbs

LIST OF SYMBOLS (Cont.)

ℓ	moment arm about center of mass..............ft
M	pitch moment................................ft-lbs
N	yaw moment..................................ft-lbs
Q	dynamic pressure............................lbs/ft^2
R	roll control moment arm.....................ft
S	aerodynamic reference area..................ft^2
T	rocket booster thrust.......................lbs
t	time..seconds
u	rocket booster control parameter............
V	velocity....................................ft/sec
W	weight of booster propellant................lbs
x	body station location.......................inches
Δy_{cg}	center of mass offset from centerline along pitch axis.............................inches
Δz_{cg}	center of mass offset from centerline along yaw axis...............................inches

Greek Letters

α	angle of attack.............................degrees
β	angle of sideslip...........................degrees
γ	flight path angle...........................degrees
δ	control surface deflection..................degrees
ϵ	misalignment angle..........................degrees
ζ	azimuth.....................................degrees
η	total aerodynamic angle.....................degrees
θ	pitch attitude..............................degrees
Λ	aerodynamic roll angle......................degrees
λ	slope of rate trace.........................degrees

LIST OF SYMBOLS (Cont.)

ϕ	roll attitude................................degrees
ψ	yaw attitude.................................degrees

Prefix

Δ	incremental value
Σ	summation

Subscripts

act	actual
aero	due to aerodynamics
cg	center of mass
cp	center of pressure or aerodynamic center
e	rocket nozzle exit
f	front of rocket chamber
fin	fixed aerodynamic fin
flex	flexible vehicle contribution
o	zero angle of attack or sideslip
p	pitch
pr	predicted
R	roll
rig	rigid body
t	rocket nozzle throat
tip	aerodynamic control surface center of force
vac	vacuum
w	wind
x	roll axis
y	yaw or transverse axis
α	angle of attack

LIST OF SYMBOLS (Cont.)

δ	due to control
ϵ	due to misalignment
r	rocket booster

Special Notation

$\bullet$	dots above symbol indicate time derivative. Each dot represents another order of differentiation.
$\partial\ /\partial X$	partial derivative with respect to parameter X.

1.0 INTRODUCTION

Post-flight analyses of a launch vehicle first stage should include an evaluation of the short period motion and the disturbances encountered. One technique, described in this report, is a deterministic evaluation of each of the terms in the rotational equations of motion. Although this is a very straightforward approach (very simple) for evaluating vehicle characteristics, it is sometimes overlooked in post-flight analysis.

The method has been used for over fifteen years for evaluation of the Scout first stage behavior. Residual disturbing moments from many flights have been used to uncover significant differences between wind tunnel data and flight data for the static stability derivatives and control surface effectiveness coefficients (References 1 through 3).

A fair amount of input data is required. It includes predicted vehicle characteristics, some of the post-flight computed trajectory parameters, booster thrust and angle of attack as well as telemetry data covering vehicle pitch, yaw and roll rates, and control surface deflections. In most circumstances the bulk of the input data is derived from computer output from several sources. In such cases the data is usually passed through simple preprocessing routines which are defined by the user to assemble a single consistent input data stream.

2.0 METHODOLOGY

Computation of the disturbing moments for a non-spinning launch vehicle first stage include computation of aerodynamic and rocket motor disturbances, control moments and the inertia terms in the equations of motion. The method presented herein is a straightforward computation of these moments and residuals necessary to balance the equations of motion. "Effective" v several characteristics such as aerodynamic stability derivatives, th misalignment and wind profile deviations are computed to eliminate th residual moments. The assumptions and equations used by the method are presented in the following paragraphs.

2.1 Assumptions

Major assumptions included in the method are:

- non-spinning nearly axisymmetric vehicle,
- cross products of inertia are zero,
- predicted aerodynamic normal force and aerodynamic center variation with angle of attack is independent of aerodynamic roll angle,
- aerodynamic surfaces (moveable fins, fin tips, elevons, flaps, etc.) and rocket controls (jet vanes, tabs, gimbaled nozzles, etc.) move in concert,
- flexibility effects on thrust misalignment and aerodynamic coefficients can be described as a functon of dynamic pressure and control forces,
- telemetry data has been preprocessed to eliminate non-rigid body responses.

2.2 Equations

2.2.1 Equations of Motion and Moments

The equations of motion for angular motion (Figure 1 presents the sign convention for vehicle motion) about the instantaneous center of mass are:

(2-1) $$I_y \ddot{\theta} = \Sigma M = M_{aero} + M_{\delta} + M_{T} + \Delta M$$

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(2-2) $I_y \ddot{\psi} = \Sigma N = N_{aero} + N_\delta + N_T + \Delta N$

(2-3) $I_x \ddot{\phi} = \Sigma L = L_{aero} + L_\delta + \Delta L$

Aerodynamic moments include the basic pitching and yawing restoring moments due to angle of attack, a static trim moment at zero angle of attack, fin misalignment effects and a damping term (see Figure 2 for Trajectory geometry).

(2-4) $M_{aero} = C_N SQ \dfrac{(x_{cg} - x_{cp})}{12} \cos\Lambda + C_{m_o} QSd + C_{L_\epsilon} QS \epsilon_{fin_p} (x_{cg} - x_{fin}) + C_{m_q} \dfrac{QSd^2}{2V} \dot{\theta}$

(2-5) $N_{aero} = C_N SQ \dfrac{(x_{cg} - x_{cp})}{12} \sin\Lambda + C_{n_o} QSd + C_{L_\epsilon} QS \epsilon_{fin_y} (x_{cg} - x_{fin}) + C_{m_q} \dfrac{QSd^2}{2V} \dot{\psi}$

(2-6) $L_{aero} = C_{\ell_o} QSd + C_{\ell_\epsilon} QSd \ \epsilon_{fin_R} + C_{\ell_p} \dfrac{QSd^2}{2V} \dot{\phi}$

Notice that with the exception of the zero angle of attack terms C_{m_o} and C_{n_o} the aerodynamic coefficients in pitch and yaw are assumed to be the same. Aerodynamic coefficients C_{m_o}, C_{n_o}, C_{L_ϵ}, C_{ℓ_ϵ}, C_{ℓ_o}, and C_{ℓ_p} are assumed to be only functions of Mach Number. Aerodynamic loads on the vehicle due to angle of attack induce a bending which distributes the aerodynamic loads different from a rigid body. On a vehicle such as Scout this effect is significant. These quasi-steady aerodynamic effects are included by defining the aerodynamic terms C_{N_α} C_{mq}, and x_{cp} as a function of Mach Number and dynamic pressure (Q). At angles of attack hi... than 2 degrees the aerodynamic normal force coefficient (C_N) and aerodynam... center (x_{cp}) become non-linear. This is included as an incremental change with total angle of attack (η), where,

(2-7) $\eta = \tan^{-1} \sqrt{\tan^2\alpha + \tan^2\beta}$

Aerodynamic normal force coefficient is

(2-8) $C_N = C_{N_\alpha} \eta + \Delta C_N$

The aerodynamic center body station is

(2-9) $x_{cp} = x_{cp_o} + \Delta x_{cp}$

Aerodynamic damping derivatives are defined about the instantaneous center of mass. Since the center of mass moves during boost a simple interpolation is used by the program between two sets of input data corresponding to two center of mass locations.

Rocket motor induced disturbing moments include thrust misalignment, center-of-mass offset and jet damping moments. Pitch and yaw moments are,

(2-10) $$M_\tau = T_{act}\frac{(x_\tau - x_{cg})\epsilon_{\tau p}}{12}/57.3 + (T_{act} - D)\frac{\Delta z_{cg}}{12} + K_{JD}\dot{\theta}$$

(2-11) $$N_\tau = T_{act}\frac{(x_\tau - x_{cg})\epsilon_{\tau y}}{12}/57.3 + (T_{act} - D)\frac{\Delta y_{cg}}{12} + K_{JD}\dot{\psi}$$

Jet damping coefficient (K_{JD}) for a rocket motor having a cylindrical bore is,

(2-12) $$K_{JD} = -\frac{T_{vac}}{(32.2)(57.3)\, I_{sp}}\left\{\frac{\left[\ell_t^2\,(2\ell_t - 3\ell_f) + \ell_f^3\right]}{3(\ell_t - \ell_f)} + 2\ell_e^2 - \ell_t^2\right\}$$

where,

$$\ell_t = (x_\tau - x_{cg})/12$$

$$\ell_f = (x_f - x_{cg})/12$$

$$\ell_e = (x_e - x_{cg})/12$$

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Thrust misalignment includes a rigid body value and a flexible vehicle value induced by aerodynamic and control loads.

(2-13) $$\epsilon_\tau = \epsilon_{\tau_{rig}} + \epsilon_{\tau_{flex}}$$

where,

(2-14) $$\epsilon_{\tau_{flex}} = 57.3\left[K_\alpha Q\alpha + K_\delta F_\delta \delta_p\right]$$

a derivation of the coefficients, K_{JD}, K_α, and K_δ, are presented in Appendix B of Reference 4.

Control moments include those derived from aerodynamic surfaces and those derived from the rocket booster. The controls are assumed to produce forces proportional to the deflection (linear) such as aerodynamic fins and jet vanes.

(2-15) $$F = (C_{N_\delta} SQ + F_{\tau_\delta})\,\delta$$

where,

C_{N_δ} is the slope of the aerodynamic control force normal force coefficient versus deflection angle

F_{τ_δ} is the jet vane force slope per degree of deflection angle

The program assumes that coefficients are for a single surface. The deflection 'δ' is per surface. The moment equations assume two surfaces for each axis.

The jet vane effectiveness is proportional to the booster vacuum thrust and a polynomial function of another independent variable 'u' which is a function of time, i.e.,

$$F_{\tau_\delta} = T_{vac}\,(a_o + a_1 u + a_2 u^2 + a_3 u^3 + \dots) \tag{2-16}$$

where,

a_i's are the polynomial coefficients

u is a function of time

This form provides a fair amount of flexibility in application. As an example, for a booster with a single gimballed nozzle control the only term necessary would be 'a_o' which would have a value of 0.008725. The Scout jet vanes are dependent upon nozzle flow parameters which can be accounted for using a first order polynomial in 'u' which has a fairly simple time history (two straight lines). The 'u' parameter may be an altitude function, nozzle erosion function or some other parameter.

The pitch, yaw, and roll moments produced by the controls are,

$$M_\delta = 2(C_{N_\delta} SQ + F_{\tau_\delta})\,\ell_\delta \delta_p \tag{2-17}$$

$$N_\delta = 2(C_{N_\delta} SQ + F_{\tau_\delta})\,\ell_\delta \delta_y \tag{2-18}$$

$$L_\delta = 2(C_{N_\delta} SQR_{tip} + F_{\tau_\delta} R_\tau)\,\delta_R \tag{2-19}$$

where,

R_{tip} is the roll moment arm of the aerodynamic surface, such as a moveable fin tip

R_τ is the roll moment arm of the jet vane or multiple gimballed nozzle

2.2.2 Residual Moments and Effective Characteristics

The equations of motion described by equations (1) through (3) include residual moments ΔM, ΔN, and ΔL. Each of the other terms can be computed based on preflight knowledge and post-flight measurements. Aerodynamic coefficients are predicted based on analytical calculations and wind tunnel tests. Mass properties can be computed fairly accurately. Fin misalignments and certain components of thrust misalignment can be measured during assembly. Angular displacements, rates and control surface deflections are usually telemetered during the flight. Rocket motor data can be estimated fairly accurately or can be determined by post-flight analyses. Angles of attack and sideslip, Mach number, dynamic pressure, velocity, and flight path

angles are generally calculated based on the combination of telemetered attitude information, radar tracking data, and measured wind profiles. A method of computing this data for the Scout launch vehicle is presented in Reference 5. Associated with each prediction and measurement is a potential error. In addition, certain parameters may not have been measured or predicted (i.e., thrust misalignment).

Therefore, in addition to computing the aerodynamic, control and booster induced moments, the most interesting parameter is the residual moments. These are calculated from equations 2-1 through 2-3, i.e.,

$$(2\text{-}20) \qquad \Delta M = I_y \ddot{\theta} - M_{aero} - M_{\tau} - M_{\delta}$$

$$(2\text{-}21) \qquad \Delta N = I_y \ddot{\psi} - N_{aero} - N_{\tau} - N_{\delta}$$

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$$(2\text{-}22) \qquad \Delta L = I_x \ddot{\phi} - L_{aero} - L_{\delta}$$

The computation of the inertia terms (sometimes referred to as the "reversed effective torque") generally requires the differentiation of body rates measured by rate gyros. Since the above equations are for rigid body motion the measured rates must be filtered to obtain rigid body motion. Low pass filters can be used. If the rate data contains a predominant structural bending mode frequency, this frequency can be nulled by two sample averaging with samples taken at twice the structural frequency. It is important to adjust all data to a common time base which requires shifting due to measurement, playback, and filtering time lags.

Usually the residual moments are analyzed in terms of an effective set of characteristics such as thrust misalignment, wind deviations, control surface effectiveness, or aerodynamic stability derivatives. In the computer program the residuals are computed in terms of these effective parameters and compared to the predicted values. There is no weighting performed. In each case the total residual is attributed to the parameter. For a single flight no meaningful trend is usually established. However, combining results from several flights will reveal any significant deviations in predicted characteristics. A method of least squares for revealing bias errors in characteristics using a larger number of flights is presented in Reference 3.

The effective set of characteristics are presented in the equations that follow.

The effective aerodynamic pitching moment is,

$$(2\text{-}23) \qquad C_m' = C_{m_{pr}} + \Delta M/QSd$$

where,

$$(2\text{-}24) \qquad C_{m_{pr}} = (C_{N_\alpha}\eta + \Delta C_N) \cos\lambda \, (x_{cg} - x_{cp_o} - \Delta x_{cp})/12d + C_{m_o}$$

The effective aerodynamic center in the pitch plane is,

(2-25) $$x'_{cp} = x_{cp_{pr}} - 12\,\Delta M \,/\, \left[(C_{N_\alpha}\eta + \Delta C_N)\, QS \cos \lambda \right]$$

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where,

(2-26) $$x_{cp_{pr}} = x_{cp_o} + \Delta x_{cp}$$

The effective thrust misalignment in the pitch plane is,

(2-27) $$\epsilon'_{\tau_p} = \epsilon_{\tau_p} + 12(57.3)\,\Delta M \,/\, \left[T_{act} (x_\tau - x_{cg}) \right]$$

The rigid body equivalent thrust misalignment in pitch is,

(2-28) $$\epsilon'_{\tau_{p_{rig}}} = \epsilon'_{\tau_p} - \epsilon_{\tau_{p_{flex}}}$$

An effective jet vane force versus deflection slope in pitch is,

(2-29) $$F'_{\tau_{\delta_p}} = F_{\tau_\delta} + 6\,\Delta M \,/\, \left[\delta_p (x_{cg} - x_\delta) \right]$$

In the yaw plane the equivalent parameters become,

(2-30) $$C'_n = C_{n_{pr}} + \Delta N \,/\, QSd$$

where,

(2-31) $$C_{n_{pr}} = (C_{N_\alpha}\eta + \Delta C_N) \sin \lambda \; (x_{cg} - x_{cp_o} - \Delta x_{cp}) \,/\, 12d + C_{n_o}$$

Yaw plane effective aerodynamic center is,

(2-32) $$x'_{cp} = x_{cp_{pr}} - 12\,\Delta N \,/\, \left[(C_{N_\alpha}\eta + \Delta C_N)\, QS \sin \lambda \right]$$

The effective thrust misalignment in the yaw plane is,

(2-33) $$\epsilon'_{\tau_y} = \epsilon_{\tau_y} + 12(57.3)\,\Delta N \,/\, \left[T_{act} (x_\tau - x_{cg}) \right]$$

and,

(2-34) $$\epsilon'_{\tau_{y_{rig}}} = \epsilon'_{\tau_y} - \epsilon_{\tau_{y_{flex}}}$$

The yaw plane jet vane effectiveness is,

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(2-35) $$F'_{\tau_{\delta_y}} = F_{\tau_\delta} + 6\,\Delta N \,/\, \left[\delta_y\,(x_{cg} - x_\delta)\right]$$

The effective rolling moment coefficient is,

(2-36) $$C'_{\ell} = C_{\ell_{pr}} + \Delta L \,/\, QSd$$

where,

(2-37) $$C_{\ell_{pr}} = C_{\ell_o} + C_{\ell_{\epsilon_{fin}}}\,\epsilon_{fin_R}$$

An artificial wind profile is computed in order to account for the residual moments. Small angle of attack and linear aerodynamic assumptions are made in the following equations. First an incremental angle of attack and sideslip is obtained from,

(2-38) $$\Delta\alpha = 12\,\Delta M \,/\, \left[C_{N_\alpha} S(x_{cg} - x_{cp}) + K_\alpha T_{act}(x_\tau - x_{cg})\right] Q$$

(2-39) $$\Delta\beta = -12\,\Delta N \,/\, \left[C_{N_\alpha} S(x_{cg} - x_{cp}) + K_\alpha T_{act}(x_\tau - x_{cg})\right] Q$$

From these expressions an incremental pitch and yaw component of wind is computed,

(2-40) $$\Delta V'_{w_p} = -V\,\Delta\alpha \,/\, \left[\Delta\alpha\,\cos\gamma - 57.3\,\sin\gamma\right]$$

(2-41) $$\Delta V'_{w_y} = V\,\Delta\beta / 57.3$$

The predicted pitch and yaw components of wind from measured values are,

(2-42) $$V_{w_p} = V_w \cos(\zeta - \zeta_w)$$

(2-43) $$V_{w_y} = V_w \sin(\zeta - \zeta_w)$$

Adding the incremental effective wind velocity components and resolving the vector yields an effective wind velocity of,

(2-44) $$V'_w = \sqrt{(V_{w_p} + \Delta V'_{w_p})^2 + (V_{w_y} + \Delta V'_{w_y})^2}$$

with a direction,

(2-45) $$\zeta'_w = \zeta + \tan^{-1}\left[(V_{w_p} + \Delta V'_{w_p}) \,/\, (V_{w_y} + \Delta V'_{w_y})\right]$$

Small angle assumptions used in these equations should result in significant errors if the incremental angle of attack or sideslip (equations 2-38 and 2-39) are over five (5) degrees. The incremental angles of attack and sideslip are printed out so that areas of dubious accuracy can be spotted.

Certain other equations are used in this computer program to compute data which may be of use in post-flight evaluations. These include evaluation of residual moments using only linear stability derivatives and not accounting for known jet damping, fin misalignments, and center of mass offset. They can be used in a post-flight trajectory simulation program which does not include these effects. The equations for the modified residual moments are:

(2-46) $$\Delta M' = I_y\ddot{\theta} - C_{N_\alpha}SQ\frac{(x_{cg} - x_{cp_o})}{12}\alpha - C_{m_o}QSd - C_{m_q}\frac{QSd^2}{2V}\dot{\theta} - \frac{T_{act}(x_T - x_{cg})\,\epsilon_{T_{flex_p}}}{12(57.3)} - 2\,(C_{N_\delta}SQ + F_{T_\delta})\ell_\delta\delta_p$$

(2-47) $$\Delta N' = I_y\ddot{\psi} + C_{N_\alpha}SQ\frac{(x_{cg} - x_{cp_o})}{12}\beta - C_{n_o}QSd - C_{m_q}\frac{QSd^2}{2V}\dot{\psi} - \frac{T_{act}(x_T - x_{cg})\,\epsilon_{T_{flex_p}}}{12(57.3)} - 2\,(C_{N_\delta}SQ + F_{T_\delta})\ell_\delta\delta_y$$

(2-48) $$\Delta L' = I_x\ddot{\phi} - C_{\ell_o}QSd - C_{\ell_p}\frac{QSd^2}{2V}\dot{\phi} - 2\,(C_{N_\delta}SQR_{tip} + F_{T_\delta}R_T)\,\delta_R$$

3.0 PROGRAM DESCRIPTION

3.1 General

This computer program is coded in FORTRAN IV for a CDC CYBER 175 system. The code is compatible with ANSI standards with the exception of the DATA statements. It is arranged to operate with standard card input and line printer output. Optional plotting is based on standard CALCOMP plotters. An optional punched card output of residual moments and effective rocket motor thrust misalignment is imbedded.

A main routine (STAGE1) and twelve subroutines require approximately 38K words of computer memory. All output is stored in array variables to facilitate a well formatted output paging system, punched card option, and CALCOMP plotting format.

Program flow and user instructions are presented in the following paragraphs. Input and output of a sample problem is illustrated along with the detailed descriptions.

3.2 Program Flow

Program flow is straightforward in five basic parts,

- input data
- compute time histories of pitch, yaw, and roll axes moments and effective characteristics
- output data on line printer
- optional punched card output
- optional CALCOMP plotted output

A flow chart of the main routine (STAGE1) is presented in Figure 3. Interaction of the main routine and the twelve subroutines is presented in Figure 4. Blank and labeled common locations in the subprograms are also presented in Figure 4. A complete listing of the FORTRAN program including all subroutines other than CALCOMP library subroutines is presented in Appendix A.

Descriptions of the subroutines are presented in the following paragraphs.

3.3 Subroutine Description

Twelve subroutines are used to support the STAGE1 main program; ACC, CURVE, DASH, DTBLN, MAXA, PAGEHD, PLS, PUNAID, SIMEQ, SMDF, TBLN, and TBLU. A brief description of each is presented below.

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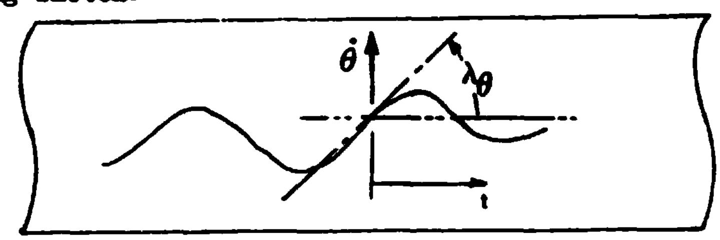
ACC

This subroutine computes angular acceleration from a slope of a graphic display of angular rate data such as an oscillograph record. Slope is assumed to be measured in degrees from the constant zero acceleration level as shown in the following sketch.



Angular acceleration is,

$$\ddot{\theta} = XKT * XKR * \tan \lambda_\theta \qquad (3\text{-}1)$$

where,

XKT is the paper speed (length units per second)
XKR is the scale factor (degrees per second per unit length)
λ_θ is the slope of the rate trace in degrees

The call statement is,

```
CALL ACC (ANSWER, XKR, XKT, MKT)
```

ANSWER - input slope in degrees (λ_θ), it is also the output angular acceleration in degrees per second squared
XKR - is rate scale factor
XKT - is paper speed or inverse of time scale factor
MKT - error indicator
= 0 normal
= 1 slope of 90 degrees or more encountered (ANSWER is set to 0)

CURVE

This subroutine sets up the CALCOMP plots including framing, titling, and curve data preparation. It is set up for specific scale factors on a series of 8 1/2 by 11 inch pages having a 10 x 10 to the centimeter graph paper. The ranges and labeling which are set are shown in the sample problem output.

Data to be plotted is obtained from the main routine through common blocks 'PLUT' and P2. The curve plotting includes combinations of simple lines, dashed, and dashed-dot, and lines with symbols which is accomplished with the DASH subroutine.

The call statement is,

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CALL CURVE (NOPT, NLP)

where,

NOPT - plot options as follows
NOPT = 1 pitch moments
= 2 yaw moments
= 3 roll moment
= 4 pitch and yaw moments and thrust misalignment
= 5 pitch, yaw, and roll moments, effective thrust misalignment, wind, and these input tables: Q, M, pitch, yaw, and roll control deflections, pitch, yaw, and roll rates, and accelerations, and angles of attack and sideslip

NLP - number of time points for each curve of output time histories

If scales or plot sizes other than those shown are desired this subroutine would be either replaced or modified.

DASH

This subroutine plots a curve on a CALCOMP plotter for a set or ordinates and abscissas. The style and type of line drawn is selected by the user. Note that the CALCOMP plot is specified in inches; plotting on metric paper requires appropriate scaling change before entering this subroutine.

The call statement is,

CALL DASH (X, Y, NP, Z1, Z2, SPACE, XSCALE, YSCALE, LSYMB, XLIM, YLIM)

where,

X - input array of abscissa values
Y - input array of ordinate values
NP - number of points in X and Y to be plotted
Z1 - for dashed-dot lines this is length of long line measured in inches (see sketch below)
Z2 - for dashed-dot lines this is length of short line measured in inches (see sketch)
SPACE - for dashed style lines this is the length of the space between lines measured in inches.
SPACE = 0 gives a solid line plot
SPACE = negative gives special CALCOMP symbols at each point
XSCALE - abscissa plot scale factor (units per inch)
YSCALE - ordinate plot scale factor (units per inch)
LSYMB - special CALCOMP symbol code number used if SPACE is negative (see code below)
- (+) LSYMB gives straight solid lines between symbol points
- (-) LSYMB gives only symbols at each point without lines
XLIM - plot limiting of the abscissa (inches) points out of range, range will appear at this limit
YLIM - plot range of ordinate (inches)

For ease in use, the following styles are typically possible,

LINE	TYPE	Z1	Z2	SPACE	LSYMB
	Solid	--	--	0.	0.
	Dashed	0.25	0.25	0.10	0.
	Dashed	0.07	0.07	0.07	0.
	Dashed Dot	0.5	0.03	0.07	0.
Δ Δ Δ Δ	Symbols	--	--	-0.1	+2
Δ Δ Δ Δ	Symbols (no line)	--	--	-0.1	-2

Some common symbols available on CALCOMP are:

LSYMB = 0 □
1 ○
2 Δ
3 +
4 X

For other special symbols see your CALCOMP plotting package manual.

DTBLN

This subroutine performs a double table lookup for two abscissas from a table arranged with abscissas in monotonically increasing order. The first abscissa is currently limited to five values and the second is limited to fifty values. It uses subroutine TBLN to perform the table lookup at th second level.

The call to this subroutine is,

```
CALL DTBLN (ORD, ABSC1, ABSC2, N1, TAB1, N2, TAB2, TORD, M1, M2)
```

where,

- ORD - returned ordinate to be found
- ABSC1 - requested abscissa of first independent variable
- ABSC2 - requested abscissa of second independent variable
- N1 - number of values in first independent variable array (current dimension limits to 5)
- TAB1 - array of abscissas for first independent variable
- N2 - number of values in second independent variable array (current dimension limits to 50)
- TAB2 - array of abscissas for second independent variable
- TORD - two dimensioned array of ordinate values, TORD (N1, N2)
- M1 - index for first search of variable one (1 to N1). index of located lookup is returned also for further use on next lookup
- M2 - index for first search of variable two (1 to N2) also modified and returned for further use

MAXA

This integer function subprogram finds the maximum absolute value in an array of numbers and sets it to an integer value.

The use is,

Y = MAXA (N,A)

where,

N = number of values in 'A' array
A = input array of numbers

PAGEHD

This short subroutine ejects a page and prints the run number and page number on top of each page of printed output.

The call statement is,

CALL PAGEHD

The run number and page number are transferred through labeled common block 'P2'.

PLS

This subroutine determines a least squares polynomial fit of data points. It uses the SIMEQ subroutine to solve the vector-matrix equation necessary to obtain the polynomial coefficient vector. It is currently dimensioned for twenty data points and up to a tenth order polynomial.

The call statement is,

CALL PLS (M, X, Y, N, C, NER)

where,

M - number of points given
X - is the given abscissa array
Y - is the given ordinate array
N - the order of the polynomial to be fitted
C - is the returned polynomial coefficients in ascending order, i.e.,

$$\hat{Y} = C(1) + C(2)\,X + C(3)X^2 + \ldots + C(N+1)X^N$$

NER - is an error indicator
NER = 0 matrix is singular and cannot be inverted
NER = 1 normal

PUNAID

This subroutine prepares the punched card output decks on tape unit seven. The punched output format is for use by other routines using a specific "NASA" type input format. It can be easily modified by reprogramming

to another suitable format. A description of the output card images is presented in paragraph 3.5.7. Data is transferred from the main routine via labeled common block "PUNSH".

The call statement is,

CALL PUNAID (J, N)

where,

J - number code of the variable to be punched from the array PUNCH(J, N)
N - number of points to be punched

The alphanumeric identifications to be punched on the cards are entered in arrays NTITL, NNTITL, and NAME through labeled common 'PUNSH'. Current dimensions limit the output to one of six having up to two hundred points.

SIMEQ

This subroutine solves a set of linear equations by matrix inversion techniques. It is currently limited to a tenth order problem (ten linear equations) of the form

(3-2) $A \cdot X = XDOT$

where,

A - is an KC by KC matrix of coefficients
X - is a vector of unknowns to be solved
XDOT - is a vector of values given

The solution is,

(3-3) $X = A^{-1} XDOT$

The call statement is,

CALL SIMEQ (A, XDOT, KC, X, IERR)

where,

A - is the matrix of given coefficients
XDOT - is the vector of known constants
KC - is the order of A or number of equations to be solved
X - is the solution vector
IERR - error code
IERR = 1 normal
IERR = 0 matrix is singular

SMDF

This subroutine performs a differentiation of a curve defined by a set of points. It first selects the appropriate number of points from a table of values. It then fits a least squares polynomial to these points. The derivative of this polynomial is then computed. This subroutine uses the PLS and SIMEQ subroutines to compute the least squares polynomial curve fit.

The fitted polynomial is of the form,

$$(3\text{-}4) \qquad \hat{Y} = A(1) + A(2)X + A(3)X^2 + \ldots + A(NOR+1)\ X^{NOR}$$

The first derivative 'Y' with respect to 'X' at X = TM is,

$$(3\text{-}5) \qquad TD = \partial Y/\partial X = A(2) + 2*A(3)*TM + 3*A(4)*TM^2 + \ldots$$

$$\ldots + NOR*A(NOR+1)*TM^{NOR-1}$$

The call statement is,

CALL SMDF (NT, T, TM, NP, NOR, TD)

where,

NT - is the number of values in the 'T' array
T - is the array of input of alternating X, Y values arranged in ascending order of X
TM - is the abscissa value at which the derivative is to be computed
NP - the number of local points equally spread about the abscissa to be used in the curve fit
NOR- is the order of the polynomial to be used in the least squares fit of 'Y' versus 'X'
TD - is the derivative computed at the abscissa 'TM' by the above procedure

TBLN

This is a single table lookup subroutine using linear interpolation between points. This subroutine requires separate arrays of abscissas and ordinates. The abscissas must be in ascending order.

The call to this subroutine is:

CALL TBLN (Y, X, T, A, NT, M)

Y - is the ordinate to be found
X - is the given abscissa.
T - is the abscissa table.
A - is the corresponding ordinate table.
NT - is the number of values in each table.
M - is a current locator for the search of the table. 'M' must be greater than zero and less than or equal to 'NT'. M returns the current location found for the abscissa and should be used for the next lookup of the same table to reduce the search time.

TBLU

This is also a single table lookup. It is based on linear interpolation between points for a single array having alternating values of abscissas and ordinates. The abscissas must be in ascending order.

The call to this subroutine is:

CAL' TBLU (NT, Y, X, T, M)

NT - number of values in table 'T' including abscissas and ordinates.
Y - is the ordinate to be found.
X - is the given abscissa.
T - is the table of alternating abscissas and r · ;ates.
M - is the table locator described under 'TBLN ve.

3.4 Input Data Description

Input data descriptions are presented in the following subparagraphs. A sample problem input data listing is presented in Figure 5 for reference. Input data can be separated into eleven (11) basic groups:

(1) tables of predicted aerodynamic coefficients,
(2) run option and arbitrary output title cards,
(3) tables of rocket booster parameters,
(4) tables of mass properties,
(5) trajectory variables,
(6) wind profile,
(7) drag, angles of attack and sideslip,
(8) telemetered vehicle data - pi.ch yaw and roll accelerations, rates and control surface deflections,
(9) single constants.
(10) output time increments,
(11) optional CALCOMP plot input data

3.4.1 Aerodynamic Coefficients

Aerodynamic coefficient tables are read in fields of ten (10), eight (8) values to a card. Unless specified otherwise, a format of (I10/(8E10.3)) is used. Each table is lead by a card containing an integer number identifying the number of numbers to be read. It is located in the first ten columns an' is right justified. Double tables are read in three phases: (1) the single table of the first independent variable, (2) a single table of the second independent variable, and (3) the dependent variable. Refer to Figure 5 for a sample input. The following order of input is used.

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FORTRAN NAME	NO. OF VALUES	SYMBOL	UNITS	DESCRIPTION
NXQT	--	--	--	number of values of dynamic pressure for double tables CNAST, CMQ1T, CMQ2T, and XCPT
XQT	(NXQT)	--	(lbs/ft^2)	dynamic pressures abscissa table (5 max)
NXM1T	--	--	--	number of values in Mach number abscissa table for CNAST
XM1T	(NXM1T)	--	--	table of Mach numbers for CNAST table (50 max)
CNAST(1,-)	NXM1T	$C_{N_\alpha}S$	(ft^2/deg)	normal force coefficient slope times reference area for first dynamic pressure and all Mach numbers
CNAST(2,-)	NXM1T	$C_{N_\alpha}S$	(ft^2/deg)	normal force coefficient slope at second dynamic pressure
CNAST(NXQT,-)	NXM1T	$C_{N_\alpha}S$	(ft^2/deg)	normal force coefficient slope at last value of dynamic pressure

The next table is a double table for the pitch damping derivative about a specified reference (CG1). The first abscissa (dynamic pressures) must be as input above. The lead card for this table includes the integer number of Mach numbers and the floating point value of (CG1). It is read with format (I10, E10.3).

FORTRAN NAME	NO. OF VALUES	SYMBOL	UNITS	DESCRIPTION
NXM2T, CG1	2	--	(-, inches)	number of Mach numbers for CMQ1T table, and reference station for CMQ1T
XM2T	NXM2T	--	--	Mach numbers for CMQ1T table (50 max)
CMQ1T(1,-)	NXM2T	C_{mq}	(1/deg)	aerodynamic damping derivative about CG1 at first value of dynamic pressure
CMQ1T(NXQT,-)	NXM2T	C_{mq}	(1/deg)	aerodynamic damping dertivative about CG1 at last value of dynamic pressure
NXM3T, CG2	2	--	(-, inches)	number of Mach numbers and reference station for CMQ2T table

FORTRAN NAME	NO. OF VALUES	SYMBOL	UNITS	DESCRIPTION
XM3T	NXM3T	--	--	Mach numbers for CMQ2T table (50 max)
CMQ2T(1,-)	NXM3T	C_{mq}	(1/deg)	aerodynamic damping derivative about CG2 at first value of dynamic pressure
CMQ2T(NXQT,-)	NXM3T	C_{mq}	(1/deg)	aerodynamic damping derivative about CG2 at last value of dynamic pressure
NXM4T	1	--	--	number of Mach numbers for XCPT table
XM4T	NXM4T	--	--	Mach numbers for XCPT table (50 max)
XCPT(1,-)	NXM4T	X_{cp_o}	(inches)	aerodynamic center table at first value of dynamic pressure
XCPT(NXM4T,-)	NXM4T	X_{cp_o}	(inches)	aerodynamic center table at last value of dynamic pressure

The remaining aerodynamic tables are single tables having alternating values of abscissas and ordinates. Each table is preceded by a card having an integer number of values in the table. Each ordinate-abscissa pair is counted as two values. The format is (I10/(8E10.3)).

FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
NT1	1	--	--	--	--	number of values in CNDST (50 max)
CNDST	NT1	$C_{N_\delta}S$	(ft^2/deg)	Mach	--	aerodynamic control surface normal force coefficient per degree deflection (one surface) number of values in CLEST (50 max)
CLEST	NT2	$C_{L_\epsilon}S$	(ft^2/deg)	Mach	--	incremental fin lift coefficient per degree of misalignment times reference area

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FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
NT3	1	--	--	--	--	number of values in XCPFNT (50 max)
XCPFNT	NT3	$X_{cp_{fin}}$	(inches)	Mach	--	fixed fin center of pressure body station
NT4	1	--	--	--	--	number of values in ETFLXT (50 max)
ETFLXT	NT4	K_α	(ft^2/deg-lbs)	Mach	--	thrust mis-alignment flexibility coefficient due to aerodynamic loads
NT5	1	--	--	--	--	number of values in DCNST (50 max)
DCNST	NT5	$\Delta C_N S$	(ft^2)	η	(deg)	non-linear incremental normal force coefficient versus aerodynamic angle
NT6	1	--	--	--	--	number of values in DXCPT (50 max)
DXCPT	NT6	ΔX_{cp}	(inches)	η	(deg)	incremental change in aerodynamic center due to aerodynamic angle
NT7	1	--	--	--	--	number of values in CMOT (50 max)
CMOT	NT7	C_{m_o}	--	Mach	--	pitching moment coefficient at zero angle of attack
NT8	1	--	--	--	--	number of values in DZCGT (20 max)
DZCGT	NT8	ΔZ_{cg}	(inches)	$\%W_{cons}$	--	center of mass offset in pitch plane versus percent propellant consumed

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FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
NT9	1	--	--	--	--	number of values in CNOT (50 max)
CNOT	NT9	C_{n_o}	--	Mach	--	yawing moment coefficient at zero angle of sideslip
NT10	1	--	--	--	--	number of values in DYCGT (20 max)
DYCGT	NT10	Δy_{cg}	(inches)	$\%W_{cons}$	--	center of mass offset in yaw plane versus percent propellant consumed
NT11	1	--	--	--	--	number of values in CLOT (100 max)
CLOT	NT11	C_{l_o}	--	Mach	--	rolling moment coefficient
NT12	1	--	--	--	--	number of values in CLERST (50 max)
CLERST	NT12	$C_{l_\epsilon} Sd$	(ft^3/deg)	Mach	--	rolling moment coefficient per degree fin misalignment times reference area and length
NT13	1	--	--	--	--	number of values in CLPT (50 max)
CLPT	NT13	$C_{l_p} Sd^2$	(ft^4/deg)	Mach	--	roll damping moment derivative times reference area and square of reference length

3.4.2 Run Option and Arbitrary Identification

The second group of input data includes four cards. The first of these contains five integers which define the run options and run numbers. These are read in five fields of ten and must be right justified. These are:

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FORTRAN NAME	COLUMN NO.	DESCRIPTION
NRUN	10	an arbitrary run number which is printed at the top of each page of output.
NACC	20	option for angular acceleration input, NACC = 0, angular acceleration input in degrees per second squared versus time. NACC = 1, rate trace slope in degrees and paper scale factors are used to compute angular accelerations (see subroutine ACC in 3.3)
NAACP	30	option for differentiation of rate by least squares polynomial NAACP = 0, accelerations or rate trace slopes must be input NAACP - 1, rate data is differentiated using SMDF subroutine. Number of points and polynomial order must be read instead of acceleration table
NPUNCH	40	control integer for optional punched card output NPUNCH = 0, no punched cards NPUNCH = 1, punched cards in "NASA Input" format are output (see sample problem output)
NPLOT	50	control integer for optional CALCOMP plot output NPLOT = 0, no plot NPLOT = 1, gives specific CALCOMP plotted output. If used group 11 input data must be used

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The next three cards contain arbitrary title data in columns 1 through 72. This information is printed on the top of each page of line printer output. There must be three cards even if blank.

3.4.3 Tables of Rocket Booster Parameters

This group of input data includes the rocket booster thrust and propellant weight remaining time histories, the predicted pitch and yaw component of thrust misalignment and the rocket control force parameters (such as jet vane lift effectiveness parameters). Each table is input with an (I10/(8E10.3)) format. See Figure 5 for sample input. Most tables have alternating values of abscissas and ordinates.

FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
NT14	1	--	--	--	--	number of values in TVACT (100 max)
TVACT	NT14	T_{vac}	(lbs)	time	(sec)	vacuum thrust versus time
NT20	1	--	--	--	--	number of values in TACT (100 max)
TACT	NT20	T_{act}	(lbs)	time	(sec)	actual thrust versus time
NT19	1	--	--	--	--	number of values in PPCT (100 max)
PPCT	NT19	W_{cons}	(lbs)	time	(sec)	booster propellant weight remaining versus time
NT28	1	--	--	--	--	number of values in ETPT (20 max)
ETPT	NT28	$\epsilon_{T_{p_{pr}}}$	(deg)	time	(sec)	predicted pitch component of thrust misalignment
NT33	1	--	--	--	--	number of values in ETYT (20 max)
ETYT	NT33	$\epsilon_{T_{y_{pr}}}$	(deg)	time	(sec)	predicted yaw component of thrust misalignment
NT15	1	--	--	--	--	number of values in ALTT (20 max)

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FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
ALTT	NT15	u	--	time	(sec)	booster control independent variable of polynomial form (see Equation 2-16)
NAT	1	--	--	--	--	number of values in A (5 max)
A	NAT	a_i	--	--	--	boost control (e.g., jet vanes) polynomial coefficients from zero order to highest order (see Equation 2-16)

3.4.4 Tables of Mass Properties

This group includes the center of mass and moments of inertia versus percent of propellant consumed. These are input with format (I10/(8E10.3)) as shown in the sample problem (Figure 5).

FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
NT23	1	--	--	--	--	number of values in XCGT (20 max)
XCGT	NT23	X_{cg}	(inches)	% W_{cons}	--	center of mass station versus percent of propellant consumed
NT22	1	--	--	--	--	number of values in XIYYT (20 max)
XIYYT	NT22	I_y	(slug/ft^2)	% W_{cons}	--	pitch or yaw moment of inertia versus percent propellant consumed
NT37	1	--	--	--	--	number of values in XIXXT (20 max)
XIXXT	NT37	I_x	(slug/ft^2)	% W_{cons}	--	roll moment of inertia versus percent propellant consumed

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3.4.5 Trajectory Variables

This group includes six trajectoy parameters. They are entered with format (I10/8E10.3)).

FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
NT16	1	--	--	--	--	number of values in QT (600 max)
QT	NT16	Q	(lbs/ft^2)	time	(sec)	dynamic pressure time history
NT17	1	--	--	--	--	number of values in VT (600 max)
VT	NT17	V	(ft/sec)	time	(sec)	relative air velocity versus time
NT18	1	--	--	--	--	number of values in XMNT (600 max)
XMNT	NT18	Mach No.	--	time	(sec)	Mach number versus time
NT42	1	--	--	--	--	number of values in GAMM (600 max)
GAMM	NT42	γ	(deg)	time	(sec)	flight path angle versus time
NT39	1	--	--	--	--	number of values in ZRT (600 max)
ZRT	NT39	ζ	(deg)	time	(sec)	relative azimuth versus time
NT38	1	--	--	--	--	number of values in ALT1 (600 max)
ALT1	NT38	h	(kilofeet)	time	(sec)	altitude versus time

3.4.6 Wind Profile

The wind speed and direction are entered versus altitude with format (I10/(8E10.3)). The altitude units must be consistent with the input altitude time history above.

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FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
NT40	1	--	--	--	--	number of values in VWH (600 max)
VWH	NT40	V_w	(ft/sec)	h	(kilo-feet)	wind, speed versus altitude
NT41	1	--	--	--	--	number of values in ZWH (600 max)
ZWH	NT41	ζ_w	(deg)	h	(kilo-feet)	wind azimuth versus altitude

3.4.7 Drag, Angles of Attack and Sideslip

These tables are input with a format (I10/(8E10.3)).

FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
NT21	1	--	--	--	--	number of values in DRAGT (600)
DRAGT	NT21	Drag	(lbs)	time	(sec)	vehicle drag versus time
NT27	1	--	--	--	--	number of values in ALPHAT (600 max)
ALPHAT	NT27	α	(deg)	time	(sec)	angle of attack versus time
NT32	1	--	--	--	--	number of values in BETAT (600 max)
BETAT	NT32	β	(deg)	time	(sec)	angle of sideslip versus time

3.4.8 Telemetered Vehicle Data

Time histories of angular accelerations, rates, and control surface deflections are input. Pitch, yaw and roll angular accelerations may be input if the appropriate option was selected (see 3.4.2 above). Options include (1) input of angular accelerations, (2) input of rate trace slopes and scale factor or, (3) input number of points and polynomial order for a least squares polynomial curve fit of rate data for differentiation.

(If NAACP = 0, NACC = 0, input format (I10,2E10.3/(8E10.3))

FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
NT24,-,-	1					number of values in the THEDDT (600 max)
THEDDT	NT24	$\ddot{\theta}$	(deg/sec^2)	time	(sec)	pitch angular acceleration versus time

(If NAACP = 0, NACC = 1, rate trace scale factors and slopes)

FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
NT24, PKTH, PKTM						number of values in THEDDT (600 max) PKTH = pitch rate trace scale factor (deg/sec/inch) PKTM = pitch rate trace paper speed (inches/sec)
THEDDT	NT24	λ_θ	(deg)	time	(sec)	pitch rate trace slopes versus time (see ACC subroutine, Section 3.3)

(If NAACP = 1, angular acceleration not read, see SMDF subroutine Section 3.3)

FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
NPCFP, NORP (Format 2I10)						NPCFP = number of points used for polynomial curve fit (20 max) NORP = order of polynomial to be used for differentiation of pitch rate trace (10th order max)

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The next two tables are input with all options with format (I10/(8E10.3)).

FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
NT25	1	--	--	--	--	number of values in THEDT (600 max)
THEDT	NT25	$\dot{\theta}$	(deg/sec)	time	(sec)	pitch rate versus time
NT26	1	--	--	--	--	number of values in PFINT (600 max)
PFINT	NT26	δp	(degrees)	time	(sec)	pitch component of control surface deflection versus time (assumed average of two surfaces)

The yaw angular acceleration, slopes or curve fit constants are read in next in the same way as described for pitch above, i.e.,

(If NAACP = 0, NACC = 0)

FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
NT29	1	--	--	--	--	number of values in PSIDDT (600 max)
PSIDDT	NT29	$\ddot{\psi}$	(deg/sec^2)	time	(sec)	yaw angular acceleration versus time

(If NAACP = 0, NACC = 1, read rate trace scale factors and slopes)

NT29, YKTH, YKTM (format (I10, 2E10.3)						number of values in PSIDDT YKTH = yaw rate trace scale factor (deg/sec/inches) YKTM = yaw rate trace paper speed (in/sec)
PSIDDT	NT29	$\lambda\psi$	(deg)	time	(sec)	yaw rate trace slopes versus time

(If NAACP = 1, read in number of points and order of polynomial for differentiation of yaw rate data by SMDF subroutine)

NPCFY, NORY (Format 2I10) — NPCFY = number of points for least square curve fit; NORY = polynomial order

The next two tables are read in regardless of option.

FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
NT30	1	--	--	--	--	number of values in PSIDT (600 max)
PSIDT	NT30	$\dot{\psi}$	(deg/sec)	time	(sec)	yaw rate versus time
NT31	1	--	--	--	--	number of values in YFINT (600 max)
YFINT	NT31	δ_y	(degrees)	time	(sec)	yaw component of control surface deflection versus time (average of two surfaces is assumed)

In similar fashion the roll angular accelerations, rates and deflections are input.

(IF NAACP = 0, NACC = 0)

FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
NT34	1	--	--	--	--	number of values in PHIDDT (600 max)
PHIDDT	NT34	$\ddot{\phi}$	(deg/sec^2)	time	(sec)	roll angular acceleration versus time

(If NAACP = 0, NACC = 1, read in roll rate trace slopes and scale factor.

NT34, RKTH, RKTM (format 'I10, 2E20.3))						number of values in PHIDDT (600 max) RKTH = roll rate trace scale factor (deg/sec/inches) RKTM = rate trace paper speed (inches/sec)
PHIDDT	NT34	λ_ϕ	(deg)	time	(sec)	roll rate trace slope versus time

(If NAACP = 1, polynomial curve fit information for SMDF)

NPCFR, NORR (format 2I10) — NPCFR = number of points for curve fit; NORR = order of polynomial

The following two tables are input regardless of acceleration options.

FORTRAN NAME	NO. OF VALUES	ORDINATE	UNITS	ABSCISSA	UNITS	DESCRIPTION
NT35	1	--	--	--	--	number of values in PHIDT (600 max)
PHIDT	NT35	$\dot{\phi}$	(deg/sec)	time	(sec)	roll rate versus time
NT36	1	--	--	--	--	number of values in RFINT (600 max)
RFINT	NT36	δ_R	(deg)	time	(sec)	roll control surface deflection versus time (average of two surfaces is assumed)

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3.4.9 Single Constants

Two cards of constants are read in this group using a Format (8E10.3), i.e., eight values per card in fields of ten columns. The order, units, and description are,

FORTRAN NAME	SYMBOL	UNITS	DESCRIPTION
EFINP	ϵ_{fin_P}	(degrees)	sum of pitch component of fixed fin misalignment (i.e., if there are two pitch fins one misaligned + 0.1 degrees and other -0.04 degrees the value + 0.06 is entered)
EFINY	ϵ_{fin_y}	(degrees)	sum of yaw component of fixed fin misalignment
EFINR	ϵ_{fin_R}	(degrees)	sum of roll component of fixed fin misalignment
XT	X_r	(inches)	body station of rocket nozzle throat (assumed point of action of thrust misalignment)
XD	X_δ	(inches)	body station of control force action
XF	X_f	(inches)	body station of front of rocket motor chamber (used in jet damping)
XE	X_e	(inches)	body station of nozzle exit plane (used in jet damping)
RTIP	R_{tip}	(feet)	radial location of aerodynamic control force from centerline
RJV	R_r	(feet)	radial location of rocket motor controls (jet vanes, gimbaled nozzles, etc.)
XISP	I_{sp}	(sec)	rocket motor specific impulse used in jet damping calculation
S	S	(ft^2)	aerodynamic reference area
D	d	(ft)	aerodynamic reference length
TMMODE	K_δ	(1/lb)	coefficient of flexible thrust misalignment induced by control force
TIME	t_o	(sec)	initial time to start problem

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3.4.10 Output Time Increments

More than one step size can be used for output. For instance, if one or more specific areas of flight require higher density output the end times and increment of each of these groups can be specified by the CTIME and DTIME arrays. The number of groups and the CTIME and DTIME arrays are entered with a format (I10/(8E10.3)).

FORTRAN NAME	UNITS	DESCRIPTION
NGPS	--	number of changes in output increment (20 max)
CTIME( ), DTIME ( )	(sec)	alternating values, CTIME = time of change or end of time group DTIME = time increment to be used for output up to end of time group CTIME

3.4.11 CALCOMP Plot Information

When CALCOMP plots are desired (NPLOT = 1) certain minimal information is input. The first input is an 80 column card of alphanumeric identification printed on the CALCOMP header preceding the first plot. This is read with a format (8A10).

The last card reads two variables with format (I10, 5X, A5). These are,

NOPT - an integer option number

- NOPT = 1 - plots pitch moments only
- NOPT = 2 - plots yaw moments only
- NOPT = 3 - plots roll moments only
- NOPT = 4 - plots pitch and yaw moments, effective thrust misalignment and winds
- NOPT = 5 - plots variables for NOPT = 4 plus roll moments and input data for deflections, α, β, rates, accelerations, Mach number, and dynamic pressure.

IPLOT - five (5) column alphanumeric vehicle identification to which is included in the heading of each CALCOMP plot. Notice in the sample problem this is (S-192).

3.5 Output Data Description

The output includes line printer output of pitch, yaw and roll data as well as optional punched card output of selected parameters (if NPUNCH = 1).

The following arrangement of line printer output occurs which can be seen in Figure 6 for the sample problem.

- pitch parameters - first page format
- pitch parameters - (continued)
- yaw parameters - first page format
- yaw parameters - (continued)
- wind parameters
- roll parameters

The top of each page of output contains the specified run number, page number and the three cards of hollerith information which appeared in the input. Detailed descriptions of these outputs follow.

3.5.1 Pitch Parameters - First Page Format

The first page format includes the following variables,

TITLE	SYMBOL	DESCRIPTION
TIME	t	time
DELTA - M	ΔM	residual pitching moment (Equation 2-20)
M(AERO)	M_{aero}	aerodynamic pitching moment (Equation 2-4)
M(CONTROL)	M_δ	pitch control moment (Equation 2-17)
M(I)	$I_y\ddot{\theta}$	pitch inertial term (reversed effective torque)
M(JD)	$K_{JD}\dot{\theta}$	pitch jet damping term (Equation 2-10)
M(CG)	$(\ell_{act}-D)\,\Delta Z_{cg}/12$	pitch moment due to center of mass offset (Equation 2-10)
M(ETFLX)	--	pitching moment due to flexibility induced thrust misalignment (Equations 2-10 & 2-14)
M(PRIME)	$\Delta M'$	residual pitching moment not including non-linear aerodynamics, fin misalignment, center-of-mass offset or jet damping (Equation 2-46)

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TITLE	SYMBOL	DESCRIPTION
ET(FLX)	$\epsilon_{\tau flex}$	pitch component of thrust misalignment induced by structural flexibility (Equation 2-14)
ET(RIGID)	$\epsilon_{\tau rig}$	pitch component of thrust misalignment excluding flexibility
ET(PRIME)		effective thrust misalignment based on M(PRIME)
(XCG - XCP)	$(X_{cg}-X_{cp})/12$	static margin

3.5.2 Pitch Parameters (Continued Page)

A second output formated page for pitch axis parameters includes the following,

TITLE	SYMBOL	DESCRIPTION
TIME	t	time
M(ALPHA)		aerodynamic pitching moment due to angle of attack (Equation 2-4 first term)
M(O)	$C_{m_o}QSd$	aerodynamic pitching moment at zero angle of attack (Equation 2-4)
M(EFIN)	$C_{L_\epsilon}QS(X_{cg}-X_{fin})\epsilon_{fin_p}$	aerodynamic pitching moment due to fin misalignment (Equation 2-4)
M(DAMP)	$C_{mq}\frac{QSd^2}{2V}\dot{\theta}$	aerodynamic pitch damping moment (Equation 2-4 last term)
CM(PRED)	$C_{m_{pr}}$	predicted aerodynamic pitching moment coefficient (Equation 2-24)
CM(EFF)	C_m'	effective aerodynamic pitching moment coefficient (Equation 2-23)
XCP(PRED)P	$X_{cp_{pr}}$	predicted aerodynamic center (Equation 2-26)
XCP(EFF)P	X_{cp}'	effective aerodynamic center in the pitch plane based on residual moments (Equation 2-25)

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TITLE	SYMBOL	DESCRIPTION
ET(EFF)P	$\epsilon_{r'p}$	effective pitch component of thrust misalignment (Equation 2-27)
LD(EFF)P	F_{r_δ}'	effective value of rocket motor control (jet vanes) effectiveness in pitch (Equation 2-29)
LD(PRED)	F_{r_δ}	predicted effectiveness of rocket motor controls (jet vanes) (Equation 2-16)

3.5.3 Yaw Parameters - First Page Format

The yaw moments and other yaw characteristics are output on two page formats. The first page has the following parameters,

TITLE	SYMBOL	DESCRIPTION
TIME	t	time
DELTA-N	ΔN	residual yawing moment (Equation 2-21)
N(AERO)	N_{aero}	aerodynamic yawing moment (Equation 2-5)
N(CONTROL)	N_δ	yaw control moment (Equation 2-18)
N(I)	$I_y \ddot{\psi}$	yaw inertia term or 'reversed effective torque'
N(JD)	$K_{JD}\dot{\psi}$	yaw jet damping moment (Equation 2-11)
N(CG)	$(T_{act}-D)\ \Delta Y_{cg}/12$	yawing moment due to center of mass offset ΔY_{cg} (Equation 2-11)
N(ETFLX)		yawing moment due to thrust misalignment induced by vehicle flexibility (Equations 2-11 & 2-14)
N(PRIME)	$\Delta N'$	residual yawing moment plus center of mass offset, jet damping, and fin misalignment (Equation 2-47)

TITLE	SYMBOL	DESCRIPTION
ET(FLX)	$\epsilon_{r\ flex}$	yaw component of thrust misalignment induced by structural flexibility (Equation 2-14)
ET(RIGID)	$\epsilon_{r_{rig}}$	yaw component of thrust misalignment exclusive of flexibility (Equation 2-13)
ET(PRIME)		yaw component of thrust misalignment based on N'
ETEFF(T)	ϵ_r'	effective total thrust misalignment (vector sum of pitch and yaw components)

3.5.4 Yaw Parameters (Continued)

A second page format of yaw parameters includes the following,

TITLE	SYMBOL	DESCRIPTION
TIME	t	time
N(ALPHA)	--	aerodynamic yawing moment change due to angle of sideslip (first term in Equation 2-5)
N(0)	$C_{n_o}QSd$	aerodynamic yawing moment at zero sideslip (2nd term Equation 2-5)
N(DAMP)	$C_{mq}\frac{QSd^2}{2V}\dot{\psi}$	yaw aerodynamic damping moment (4th term Equation 2-5)
CN(PRED)	$C_{n_{pr}}$	predicted aerodynamic yawing moment coefficient (Equation 2-31)
CN(EFF)	C_n'	effective aerodynamic yawing moment coefficient (Equation 2-30)
XCP(PRED)Y	$X_{cp_{pr}}$	predicted aerodynamic center (Equation 2-26)
ET(EFF)Y	$\epsilon_{r'y}$	effective yaw component of thrust misalignment (Equation 2-33)

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TITLE	SYMBOL	DESCRIPTION
LD(EFF)Y	F'_{r_δ}	effective value of rocket motor control (jet vanes) in yaw (Equation 2-35)
LD(PRED)	F_{r_δ}	predicted value of rocket motor control effectiveness (jet vanes) (Equation 2-16)

3.5.5 Wind Parameters

A page format of wind related parameters includes,

TITLE	SYMBOL	DESCRIPTION
TIME	t	time
ALTITUDE	h	altitude in kilofeet.
WIND VELOCITY	V_w	wind velocity as input
EFFECTIVE WIND VEL	V_w'	effective wind velocity (Equation 2-44)
DELTA WIND VEL	ΔV_w	incremental wind velocity necessary to null residual moments in pitch and yaw (Equations 2-40 and 2-41)
WIND DIRECTION	ζ_w	wind direction (azimuth) as input
EFFECTIVE WIND DIR	ζ_w'	effective direction of V'_w (Equation 2-45)
DELTA ALPHA	$\Delta\alpha_w$	incremental change in angle of attack necessary to null residual pitching moment (Equation 2-38)
DELTA BETA	$\Delta\beta_w$	incremental change in angle of sideslip necessary to null residual yawing moment (Equation 2-39)

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3.5.6 Roll Parameters

A page format of roll parameters includes,

TITLE	SYMBOL	DESCRIPTION
TIME	t	time
DELTA-L	ΔL	residual roll moment (Equation 2-22)
L(AERO)	L_{aero}	aerodynamic rolling moment (Equation 2-6)
L(CONTRL)	L_{δ}	roll control moment (Equation 2-19)
L(I)	$I_x\ddot{\phi}$	roll inertia moment or reversed-effective-torque
CL(EFF)	C_{ℓ}'	effective aerodynamic rolling moment coefficient (Equation 2-36)
L(AEROP)	$\Delta L'$	aerodynamic rolling moment excluding fin misalignment (Equation 2-22)
CL(EFFP)	$C_{\ell_{pr}} + \Delta L'/QSd$	effective aerodynamic rolling moment based on residual moments including fin misalignment
DELTA-LP	$\Delta L'$	residual rolling moment plus fin misalignment term (Equation 2-48)

3.5.7 Punched Card Output

When the punched card output option is used residual moments and effective thrust misalignment is punched in the 'NASA-INPUT' format shown in Figure 7. This output is from the sample problem. The output tables include,

TITLE	SYMBOL	OUTPUT NAME	DESCRIPTION
TIME	t	TAUM	time (seconds)
PITCH MOMENT	ΔM	DPITCH	residual pitching moment (ft-lbs)

TITLE	SYMBOL	OUTPUT NAME	DESCRIPTION
PITCH THRUST MIS.	ϵ'_{r_p}	DPITCH	effective pitch component of thrust misalignment (degrees)
YAW MOMENT	ΔN	DYAW	residual yawing moment coefficient (ft-lbs)
YAW THRUST MIS	ϵ'_{r_y}	DYAW	effective yaw component of thrust misalignment (degrees)
ROLL MOMENT	ΔL	DROLL	residual rolling moment (ft-lbs)

3.5.8 CALCOMP Plots

The optional CALCOMP plot output is presented in figures 8 through 18. The parameters on the plots include,

FIGURE	FRAME	LABEL	SYMBOL OR EQUATION
8	1	CONTROL MOMENT	M_δ
8	1	REV. EFF. TORQUE	$I_y\ddot{\theta}$
8	1	AERODYNAMIC	M_{aero}
8	1	RESIDUAL MOMENT	ΔM
9	2	EFFECTIVE THRUST MISALIGNMENT	
9	2	Pitch	ϵ'_{r_p}
9	2	Yaw	ϵ'_{r_y}
		Total	$\sqrt{\epsilon'^{2}_{r_p} + \epsilon'^{2}_{r_y}}$
10	3	WIND VELOCITY MEASURED	V_w
10	3	Effective	V'_w
11	4	WIND DIRECTION MEASURED	ζ_w
11	4	Effective	ζ'_w
12	5	CONTROL MOMENT	N_δ
12	5	REV. EFF. TORQUE	$I_y\ddot{\psi}$
12	5	AERODYNAMIC	N_{aero}
12	5	RESIDUAL	ΔN

FIGURE	FRAME	LABEL	SYMBOL OR EQUATION
13	6	ROLL MOMENT	ΔL
14	7	DYNAMIC PRESSURE	Q
14	7	MACH NO.	
15	8	PITCH FIN	δ_p
15	8	YAW FIN	δ_y
15	8	ROLL FIN	δ_R
16	9	PITCH RATE	$\dot{\theta}$
16	9	YAW RATE	$\dot{\psi}$
16	9	ROLL RATE	$\dot{\phi}$
-	10	PITCH ACCELERATION (if input)	$\ddot{\theta}$
-	10	YAW ACCELERATION (if input)	$\ddot{\psi}$
-	10	ROLL ACCELERATION (if input)	$\ddot{\phi}$
17	11	ANGLE OF SIDESLIP	β
18	12	ANGLE OF ATTACK	α

4.0 REFERENCES

1. Brassard, J. A., Knauber, R. N, and Melugin, J. E., "Scout First Stage Moment Disturbance Study," Vought Corporation Report 23.287 dated 15 July 1966.

2. Knauber, R. N. and Yanowitch, S., "Scout First Stage Flight Characteristics," Vought Corporation Report No. 23.358 dated 15 March 1968.

3. Knauber, R. N. and Myler, T. R., "Algol III First Stage Residual Pitching and Yawing Moment Characteristics," Vought Corporation Design Information Release No. 23-DIR-1927 dated 14 September 1976.

4. Knauber, R. N. and Glazier, M. N., "First Stage Moment Disturbance Routine - LVVZ-45," Vought Corporation Report 23.307, Revision A dated 23 January 1970.

5. Spacek, J. A. and Hrach, W. V., "Computation of Aerodynamic Angles From Radar and Telemetry Data," Vought Corporation Report No. 00.769, Revision B dated 9 January 1973.

Figure 1
Sign Convention

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(arrowheads indicate positive sense)

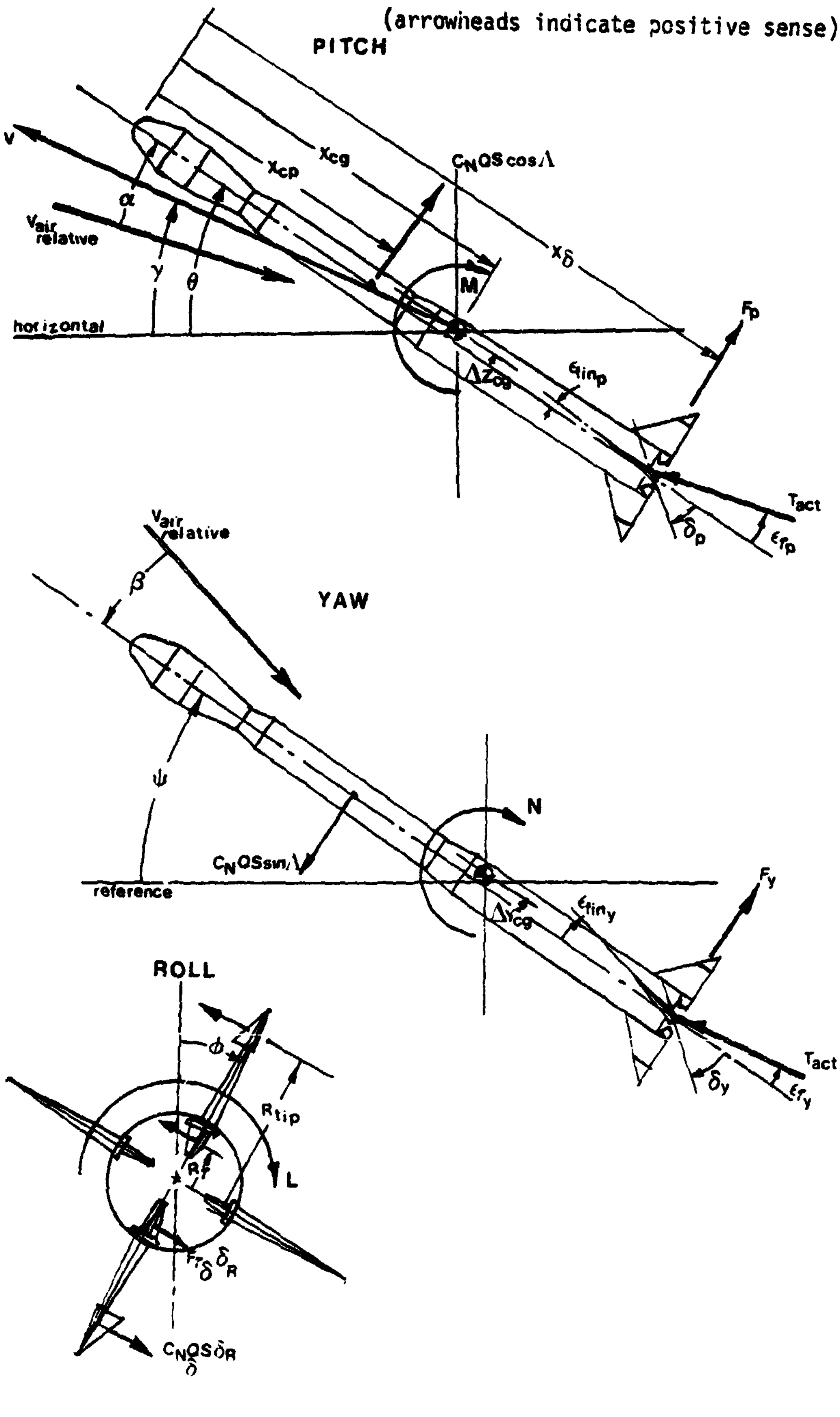
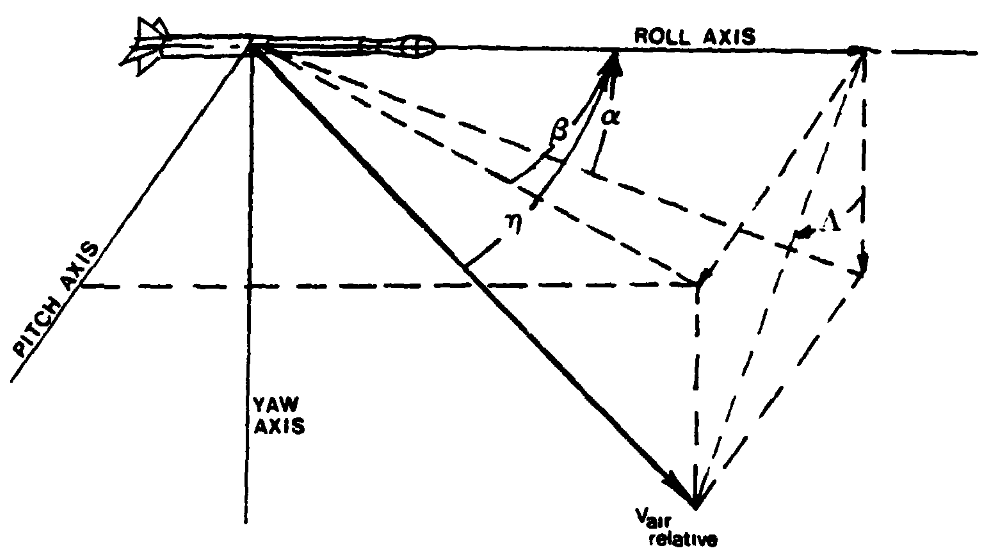


Figure 2
Trajectory Geometry

(arrowheads indicate positive sense)



$$\eta = \mathrm{Tan}^{-1}\sqrt{\mathrm{Tan}^2\alpha + \mathrm{Tan}^2\beta}$$

$$\mathrm{Sin}\,\Lambda = \mathrm{Tan}\,\beta\Big/\sqrt{\mathrm{Tan}^2\alpha + \mathrm{Tan}^2\beta}$$

$$\mathrm{Cos}\,\Lambda = \mathrm{Tan}\,\alpha\Big/\sqrt{\mathrm{Tan}^2\alpha + \mathrm{Tan}^2\beta}$$

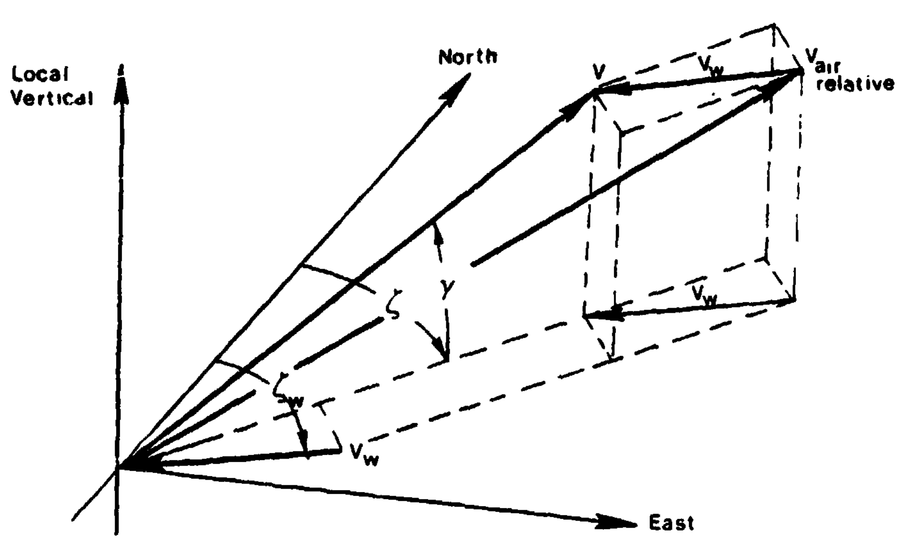


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Figure 3
Flow Chart of STAGE1 Program

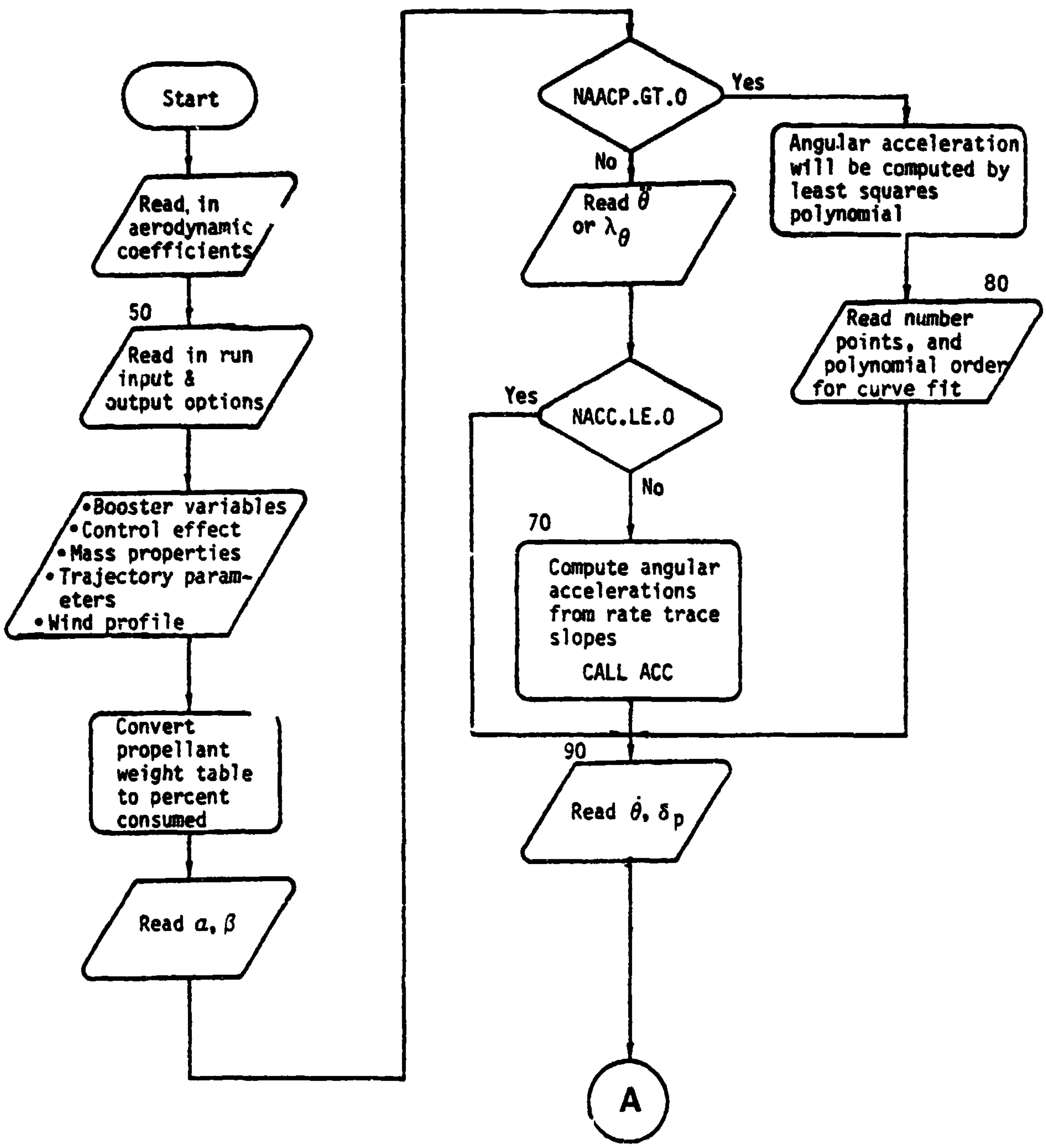

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Figure 3 (continued)
Flow Chart of STAGE1 Program

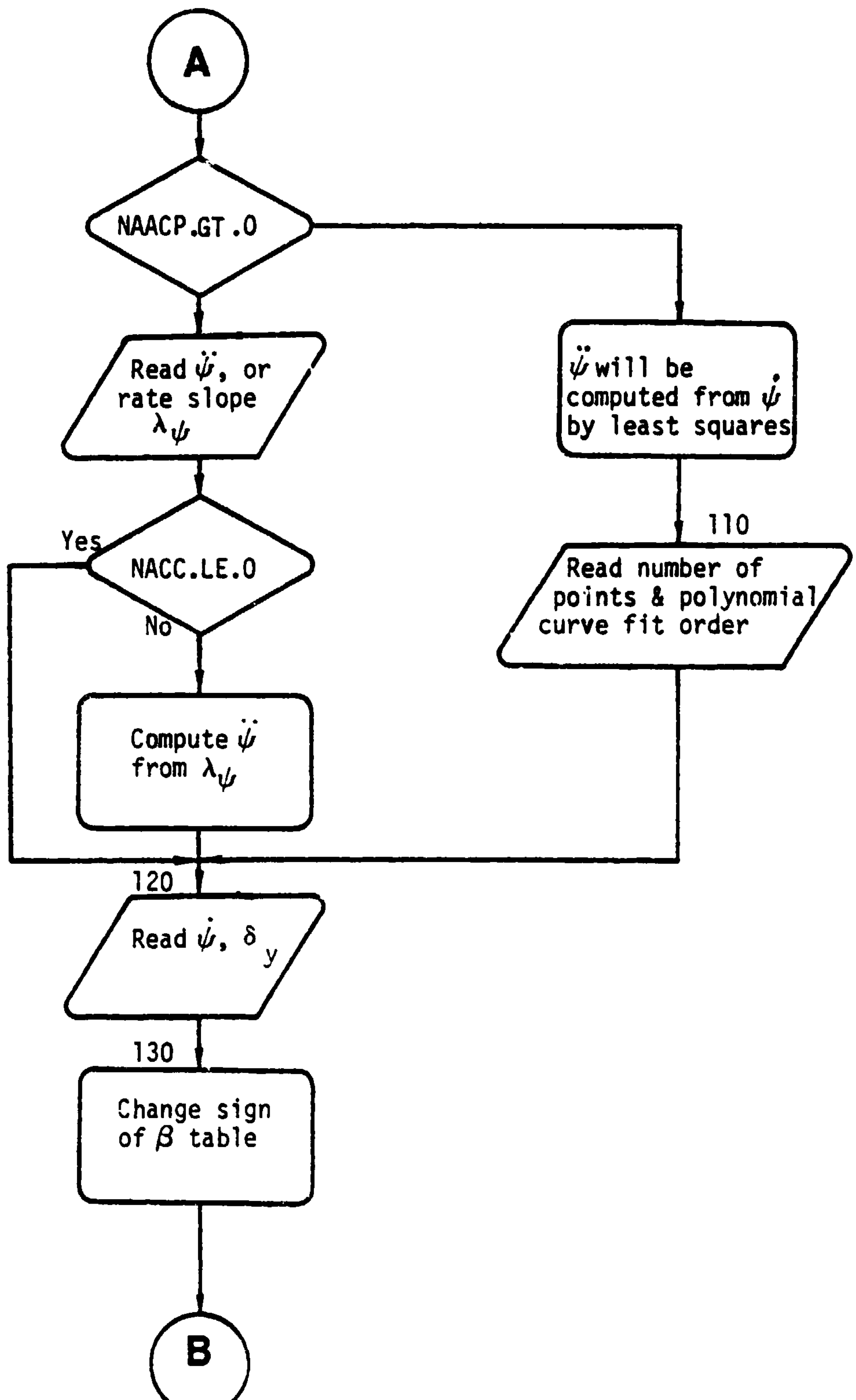

Figure 3 (continued)
Flow Chart of STAGE1 Program

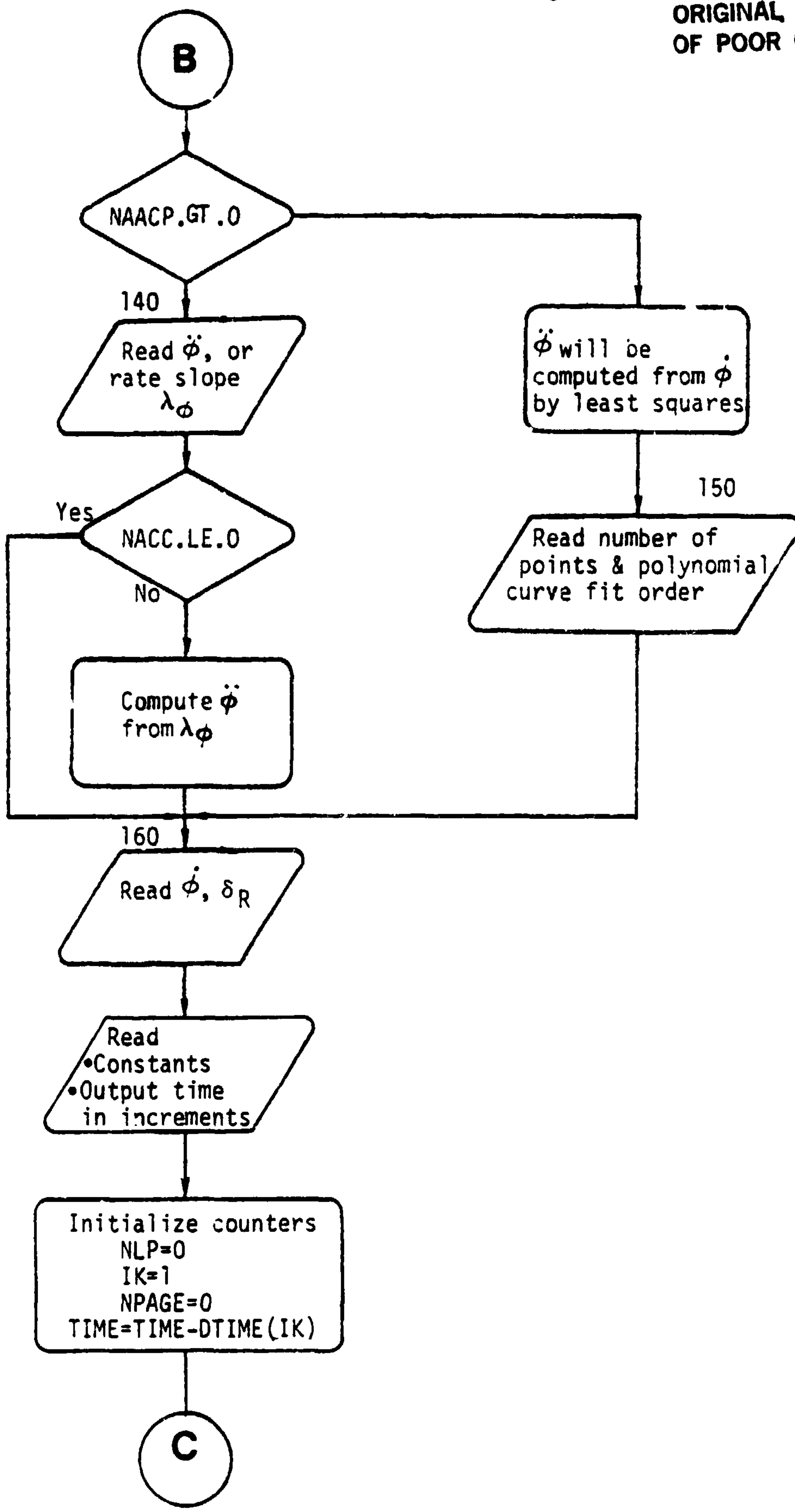

Figure 3 (continued)
Flow Chart of STAGE1 Program

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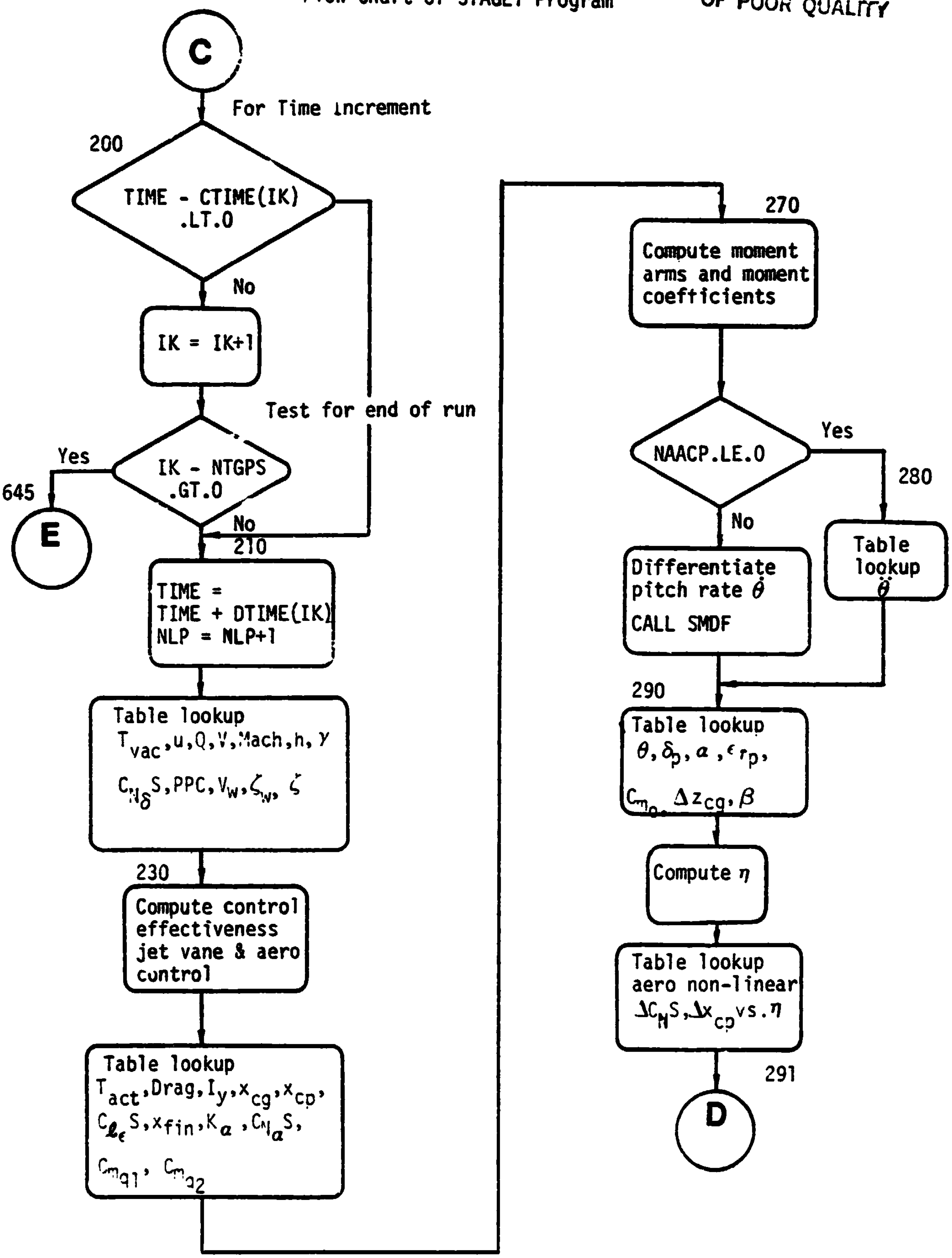

Figure 5 (Continued)
Flow Chart of STAGE1 Program

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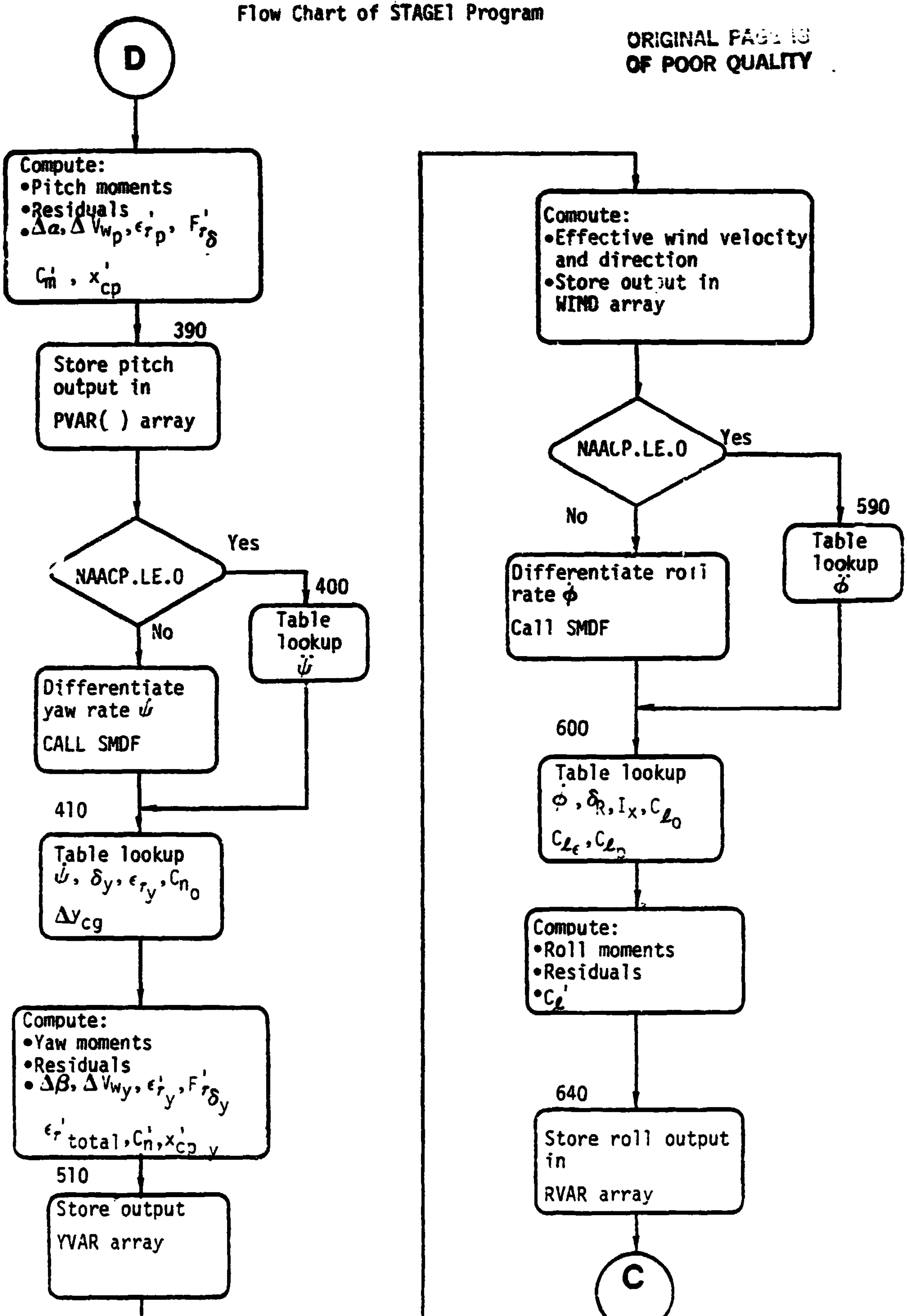

Figure 3 (concluded)
Flow Chart of STAGE1 Program

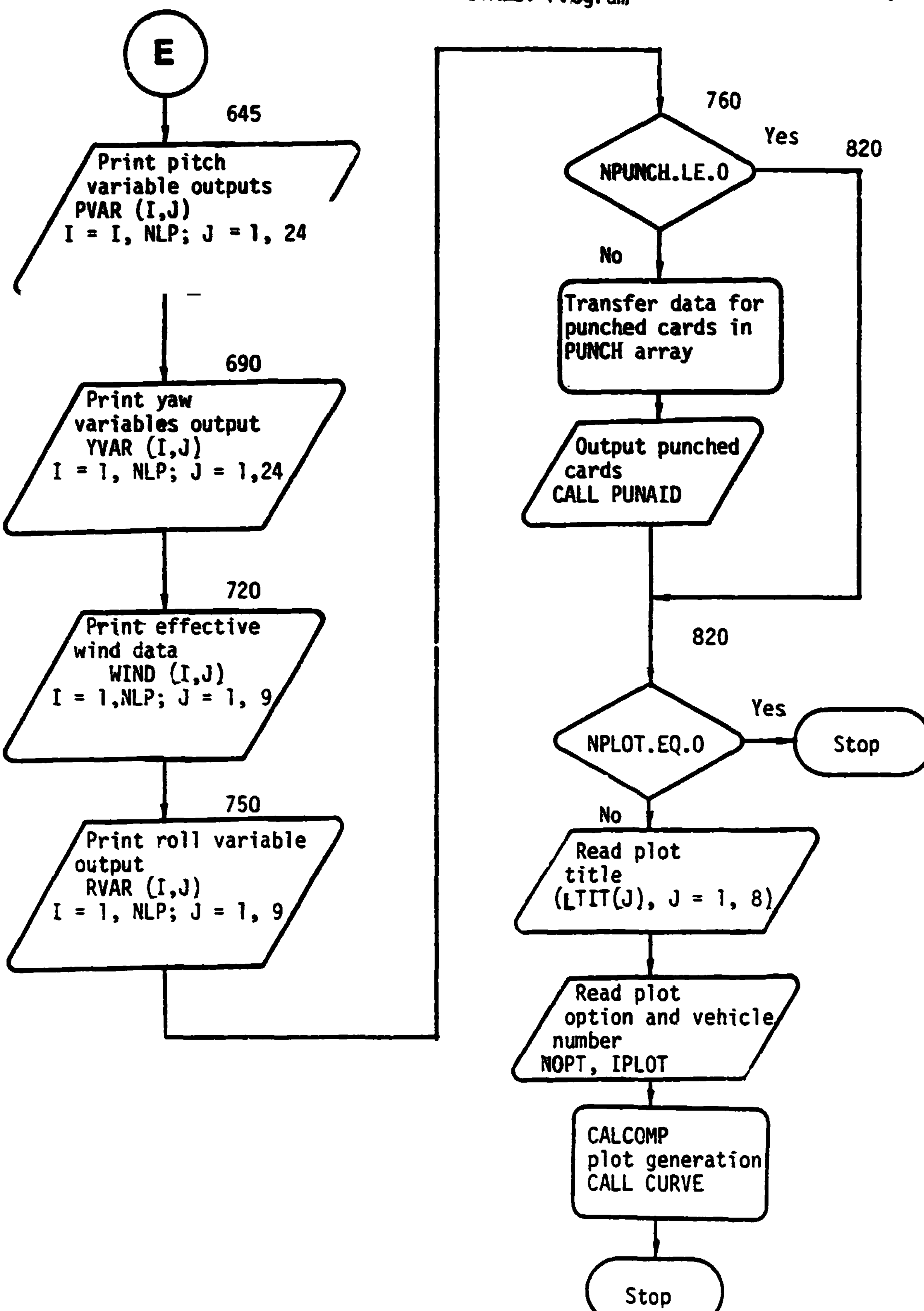

Figure 4
Program Subroutines and Common Interaction Map

	Subroutines Called													Common		
	ACC	CURVE	DASH	DTBLN	MAXA	PAGEHD	PLS	PUNAID	SIMEQ	SMDF	TBLN	TBLU	CALCOMP LIBRARY	P2	PLUT	PUNSH
STAGE1 (MAIN)	*	*		*		*		*		*		*		*	*	*
ACC																
CURVE			*		*								*		*	*
DASH													*			
DTBLN											*					
MAXA																
PAGEHD														*		
PLS									*							
PUNAID																*
SIMEQ																
SMDF							*									
TBLN																
TBLU																

Figure 5
Sample Problem Input

```
     4         DYNAMIC PRESSURES FOR AERO COEFFICIENTS
    0.     1500.     2500.     3500.
    15         MACH NUMBERS AND NORMAL FORCE COEFFICIENT SLOPE
  0.00       .20       .40       .60       .80       .95      1.00      1.05
  1.30      1.60      1.90      2.50      3.00      3.50      4.68
 1.503     1.525     1.556     1.608     1.718     1.759     1.759     1.736
 1.562     1.402     1.270     1.093     1.017      .979      .946
 1.493     1.515     1.544     1.594     1.686     1.708     1.706     1.695
 1.562     1.425     1.308     1.141     1.067     1.022      .987
 1.489     1.508     1.539     1.585     1.657     1.672     1.671     1.658
 1.562     1.434     1.329     1.182     1.109     1.063     1.018
 1.484     1.505     1.536     1.580     1.629     1.640     1.635     1.631
 1.562     1.466     1.379     1.239     1.164     1.111     1.064
    15    530.00    NO. MACH NUMBERS AND CG1 FOR DAMPING DERIVATIVE
  0.00       .20       .40       .60       .80       .95      1.00      1.05
  1.30      1.60      1.90      2.50      3.00      3.50      4.68
-1070.    -1111.    -1160.    -1220.    -1255.    -1180.    -1150.    -1135.
-1110.    -1035.    -1010.     -965.     -920.     -890.     -815.
-1125.    -1155.    -1210.    -1255.    -1280.    -1200.    -1160.    -1150.
-1120.    -1090.    -1090.    -1075.    -1035.    -1030.     -905.
-1460.    -1185.    -1230.    -1290.    -1300.    -1210.    -1165.    -1150.
-1135.    -1140.    -1170.  [illegible] -1125.    -1090.     -990.
-1185.    -1215.    -1260.  [illegible] -1340.    -1240.    -1180.    -1170.
-1150.    -1210.    -1270.  [illegible] -1230.    -1230.    -1140.
    15    427.80    NO. MACH NUMBERS AND CG2 FOR DAMPING DERIVATIVE
  0.00       .20       .40       .60       .80       .95      1.00      1.05
  1.30      1.60      1.90      2.50      3.00      3.50      4.68
-1470.    -1510.    -1550.    -1620.    -1710.    -1720.    -1700.    -1680.
-1450.    -1250.    -1140.     -985.     -900.     -835.     -753.
-1470.    -1500.    -1550.    -1610.    -1680.    -1680.    -1660.    -1630.
-1430.    -1270.    -1175.    -1050.     -975.     -915.     -810.
-1470.    -1500.    -1540.    -1600.    -1660.    -1660.    -1630.    -1610.
-1400.    -1290.    -1220.    -1110.    -1030.     -970.     -865.
-1460.    -1490.    -1530.    -1600.    -1645.    -1640.    -1620.    -1590.
-1390.    -1300.    -1270.    -1180.    -1110.    -1035.     -935.
```

Figure 5 (continued)
Sample Problem Input

```
  15     MACH NUMBERS AND XCP VERSUS MACH AND DYNAMIC PRESSURE
0.00       .40       .60       .80       .90       .95      1.05      1.10
1.20      1.40      1.60      1.80      2.60      3.50      4.75
660.      650.      653.      676.      696.      700.      701.      698.
682.      623.      583.      550.      469.      425.      422.
633.      623.      627.      648.      680.      689.      690.      684.
660.      603.      560.      520.      435.      399.      395.
615.      605.      610.      630.      665.      678.      679.      670.
640.      587.      542.      500.      406.      376.      373.
592.      584.      589.      609.      636.      660.      667.      656.
627.      570.      523.      475.      373.      350.      350.
  32     AERO CONTROL  COEFFICIENTS
0.00     .0360       .20     .0399       .40     .0433       .60     .0475
 .80     .0515       .90     .0525       .95     .0505      1.00     .0475
1.30     .0342      1.60     .0260      1.90     .0209      2.50     .0159
3.00     .0142      3.50     .0129      4.50     .0108      5.00     .0100
  36     FIN LIFT COEFFICIENT DUE TO MISALIGNMENT
0.00     .3596       .40     .3728       .60     .3938       .75     .4148
 .90     .4463      1.00     .4620      1.10     .4253      1.20     .3675
1.30     .3360      1.50     .2861      1.80     .2310      2.00     .2021
2.25     .1785      2.50     .1575      3.00     .1339      3.50     .1155
4.50     .0945      5.00     .0866
  14     FIN CENTER OF PRESSURE VS. MACH
0.00    840.00       .60    840.00       .90    841.00      1.00    843.00
1.20    844.00      2.00    845.25      5.00    845.25
  30     AERO INDUCED THRUST MISALIGNMENT DUE TO FLEXIBILITY
0.00  .511E-06       .20  .523E-06       .40  .542E-06       .60  .570E-06
 .75  .596E-06       .90  .586E-06      1.00  .548E-06      1.15  .504E-06
1.25  .484E-06      1.60  .457E-06      2.00  .453E-06      2.50  .443E-06
3.00  .415E-06      3.50  .384E-06      4.68  .293E-06
```

Figure 5 (continued)
Sample Problem Input

```
    26   DELTA CNS VERSUS TOTAL ANGLE OF ATTACK-NONLINEAR
   0.0     0.00    10.0     0.00     15.0     4.00     20.0    10.00
  25.0    22.00    30.0    30.00     45.0    52.00     55.0    72.00
  65.0    88.00    70.0    92.00     80.0    94.00     85.0    92.00
  90.0    85.00
    24   DELTA XCP VERSUS ANGLE OF ATTACK NON-LINEAR PORTION
   0.0     0.00     5.0    -2.50      7.5   -13.00     10.0   -33.00
  14.0   -84.00    16.0   -99.00     27.0  -124.00     30.0  -135.00
  35.0  -172.00    40.0  -186.00     50.0  -193.00     90.0  -185.00
    30   CMO - PITCH MOMENT COEFFICIENT AT ZERO ALPHA
  0.00    .3000     .50    .3000      .70    .2800      .80    .2270
   .90    .1230    1.00    .1000     1.25    .1000     1.50    .1650
  1.75    .2800    2.00    .3700     2.40    .4650     2.80    .5100
  3.20    .5280    4.00    .5300     5.00    .5300
    10   ZCG - PITCH PLANE CG OFFSET VERSUS PERCENT WEIGHT CONSUMED
  0.00    .0590   25.00    .0680    50.00    .0800    75.00    .1000
100.00    .1300
    14   CNO - YAWING MOMENT COEFFICIENT AT ZERO BETA VS. MACH NO.
  0.00   0.0000    1.00   0.0000     1.40   -.0120     1.70   -.1000
  2.60   -.0920    3.20   -.1000     5.00   -.1000
    10   YCG - YAW PLANE CG OFFSET VERSUS PERCENT WEIGHT CONSUMED
  0.00    .0030   25.00    .0031    50.00    .0040    75.00    .0045
100.00    .0100
     4   CLO - AERODYNAMIC ROLL MOMENT COEFFICENT BIAS VS. MACH
  0.00   0.0000    5.00   0.0000
    30   ROLLING MOMENT COEFFICIENT DUE TO FIN MISALIGNMENT VS. MACH NO.
  0.00    .7450     .40    .8127      .75    .9075     1.00   1.0159
  1.10   1.0159    1.20    .9820     1.50    .8262     1.80    .6502
  2.00    .5418    2.25    .4673     2.50    .4199     3.00    .3589
  3.50    .3115    4.50    .2506     5.00    .2303
    26   ROLL DAMPING DERIVATIVE VS. MACH NUMBER
  0.00 -14.3000     .20 -14.9000      .40 -15.4000      .80 -16.2000
   .90 -16.5000    1.00 -16.8000     1.10 -16.8000     1.50 -15.2000
  2.00 -11.4000    2.50  -8.7500     3.00  -7.1000     3.50  -6.0900
  4.50  -5.4600
```

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Figure 5 (continued)

Sample Problem Input - Options and Propulsion Parameters

```
      1          0          1          0          1
S-192 POST FLIGHT FIRST STAGE MOMENTS  NOVA I
ALGOL III SCOUT G-1  34/-40 HEATSHIELD
OLD AERODYNAMICS  18 AUG 1981
       64      VACUUM THRUST VS. TIME
     0.00        0.        .31    147483.        .89   122243.       1.39   115488.
     2.19   110107.       3.69    104805.       8.19   100085.      10.19    98063.
    12.69    97700.      16.19     98535.      19.69    95233.      21.69    92942.
    24.19    92454.      30.19     96895.      36.19   101382.      44.19   108762.
    48.19   112475.      52.19    115507.      57.19   120897.      59.14   122994.
    58.99   123151.      59.39    122078.      62.19   101384.      64.69    77358.
    66.69    61411.      68.69     47521.      72.19    29665.      74.19    22164.
    77.19    12927.      80.19      7232.      83.19     4139.      86.32     2342.
       64      ACTUAL THRUST VS. TIME
     0 00        0.        .31    135768.        .89   110366.       1.39   103551.
     2.19    98104.       3.69     92744.       8.19    88097.      10.19    86229.
    12.69    86131.      16.19     87410.      19.69    84691.      21.69    82847.
    24.19    82923.      30.19     88693.      36.19    94577.      44.19   103869.
    48.19   108543.      52.19    112347.      57.19   118245.      59.14   120576.
    58.99   120713.      59.39    119701.      62.19    99522.      64.69    76072.
    66.69    60506.      68.69     46908.      72.19    29352.      74.19    21952.
    77.19    12803.      80.19      7153.      83.19     4082.      86.32     2300.
       64      WEIGHT OF PROPELLANT REMAINING VS. TIME
     0.00    28226.        .31     28140.        .89    27843.       1.39    27602.
     2.19    27237.       3.69     26585.       8.19    24744.      10.19    23967.
    12.69    23000.      16.19     21657.      19.69    20346.      21.69    19598.
    24.19    18679.      30.19     16493.      36.19    14221.      44.19    10964.
    43.19     9237.      52.19      7511.      57.19     5352.      59.14     4409.
    58.99     4482.      59.39      4288.      62.19     3047.      64.69     2161.
    66.69     1610.      68.69      1178.      72.19      642.      74.19      437.
    77.19      228.      80.19       108.      83.19       40.      86.32        0.
        4      PREDICTED PITCH COMPONENT OF THRUST MISALIGNMENT VS. TIME
     0.00    0.0000    1000.00    0.0000
        4      PREDICTED YAW COMPONENT OF THRUST MISALIGNMENT VS. TIME
     0.00    0.0000    1000.00    0.0000
```

Figure 5 (continued)
Sample Problem Input - Rocket Control and Mass Properties

```
       8     JET VANE EFFECTIVENESS PARAMETER VS. TIME
    0.00        0.       7.00        6.     56.00        13.    100.00        13.
       2     JET VANE EFFECTIVENESS POLYNOMIAL COEFFICIENTS
 .000460   -.000010
      10     XCG - CENTER OF MASS STATION VS. PERCENT PROPELLANT CONSUMED
    0.00       537.     25.00      517.     50.00       489.     75.00       446.
  100.00       372.
      10     IYY - TRANSVERSE MOMENT OF INERTIA VS. PERCENT PROPELLANT CONSUME
    0.00    426453.     25.00   391579.     50.00    346818.     75.00    284380.
  100.00    185224.
      10     IXX - ROLL MOMENT OF INERTIA VS. PERCENT PROPELLANT CONSUMED
    0.00      2418.     25.00     2313.     50.00      2023.     75.00      1548.
  100.00       886.
```

Figure 5 (continued)
Sample Problem Input - Trajectory Parameters

```
   38      DYNAMIC PRESSURE VS. TIME
  0.00        0.       5.00        45.     10.00       129.      15.00       263.
 20.00      448.      25.00       650.     30.00       879.      35.00      1115.
 40.00     1349.      45.00      1577.     50.00      1682.      55.00      1650.
 60.00     1472.      65.00      1059.     70.00       653.      75.00       373.
 80.00      212.      85.00       124.     87.00       101.
   38      RELATIVE AIR VELOCITY VS. TIME
  0.00       19.       5.00       196.     10.00       338.      15.00       505.
 20.00      689.      25.00       882.     30.00      1099.      35.00      1338.
 40.00     1615.      45.00      1959.     50.00      2364.      55.00      2942.
 60.00     3572.      65.00      4096.     70.00      4375.      75.00      4479.
 80.00     4472.      85.00      4437.     87.00      4483.
   38      MACH NUMBER VS. TIME
  0.00     .0170       5.00      .1770     10.00      .3060      15.00      .4550
 20.00     .6250      25.00      .8050     30.00     1.0170      35.00     1.2660
 40.00    1.5750      45.00     1.9870     50.00     2.4750      55.00     3.0530
 60.00    3.7130      65.00     4.1990     70.00     4.4380      75.00     4.4520
 80.00    4.3940      85.00     4.3210     87.00     4.3380
   38      FLIGHT PATH ANGLE VS. TIME
  0.00   90.0000       5.00    85.9240     10.00    77.4300      15.00    71.5410
 20.00   66.8440      25.00    62.3570     30.00    58.0150      35.00    54.2030
 40.00   50.0720      45.00    46.7720     50.00    43.8230      55.00    41.5170
 60.00   39.5500      65.00    37.8040     70.00    36.2210      75.00    34.5320
 80.00   32.8970      85.00    31.2320     87.00    30.5120
   38      RELATIVE AZIMUTH VS. TIME
  0.00  360.0000       5.00   185.6870     10.00   184.6520      15.00   183.1180
 20.00  184.1500      25.00   183.6310     30.00   183.4630      35.00   183.2060
 40.00  183.3990      45.00   183.0130     50.00   182.5730      55.00   182.4860
 60.00  182.4560      65.00   182.5890     70.00   182.6550      75.00   182.6910
 80.00  182.7940      85.00   182.8520     87.00   182.7730
   38      ALTITUDE IN KILOFEET VS. TIME
  0.00        0.       5.00         1.     10.00         2.      15.00         4.
 20.00        7.      25.00        11.     30.00        15.      35.00        20.
 40.00       26.      45.00        33.     50.00        41.      55.00        50.
 60.00       60.      65.00        72.     70.00        85.      75.00        98.
 80.00      110.      85.00       122.     87.00       127.
```

Figure 5 (continued)
Sample Problem Input - Wind and Drag

```
    72      WIND VELOCITY VS. ALTITUDE IN KILOFEET
   .33     19.       .47      21.       .84      27.      1.45       37.
  2.19     38.      3.12      40.      4.24      47.      5.56       48.
  7.08     56.      8.79      65.     10.69      67.     12.76       63.
 15.03     57.     17.48      56.     20.14      59.     22.98       68.
 26.05     73.     29.43      79.     32.97      94.     36.69      115.
 40.74    117.     45.11      52.     49.80      54.     54.86       25.
 60.31     19.     66.16       4.     72.31      19.     78.65       28.
 85.08     40.     91.52      40.     97.91      30.    104.19       56.
110.34     62.    116.32      46.    122.14      62.    126.62       49.
    72      WIND DIRECTION VS. ALTITUDE IN KILOFEET
   .33 325.0000      .47 324.5570       .84 323.3730      1.45  321.4190
  2.19 322.9950     3.12 325.5080      4.24 327.0000      5.56  325.2000
  7.08 324.2420     8.79 325.0630     10.69 307.2510     12.76  302.3240
 15.03 305.9180    17.48 311.0000     20.14 313.4680     22.98  313.1830
 26.05 317.1400    29.43 327.9460     32.97 332.0000     36.69  337.2570
 40.74 334.0130    45.11 294.9920     49.80 287.9880     54.86  268.5640
 60.31 244.4310    66.16 172.4290     72.31  96.1620     78.65   75.0290
 85.08  82.8170    91.52 100.0000     97.91  62.5280    104.19   78.4800
110.34  75.0000   116.32  90.0000    122.14  98.2110    126.62   88.1450
    38      DRAG VS. TIME
  0.00      1.      5.00     163.     10.00     477.     15.00     1007.
 20.00   1807.     25.00    3350.     30.00    6900.     35.00    10649.
 40.00  13589.     45.00   14838.     50.00   13957.     55.00    12678.
 60.00  10417.     65.00    6897.     70.00    4098.     75.00     2389.
 80.00   1408.     85.00     858.     87.00     704.
```

Figure 5 (continued)
Sample Problem Input - Angles of Attack and Sideslip

178	ANGLE OF	ATTACK VS.	TIME				
0.00	-89.8080	1.00	-18.6950	2.00	-11.0620	3.00	-9.8630
4.00	-9.9350	5.00	-9.3930	6.00	-8.7930	7.00	-8.2580
8.00	-7.4020	9.00	-5.8970	10.00	-4.9370	11.00	-4.2250
12.00	-3.5030	13.00	-3.3010	14.00	-3.0770	15.00	-2.7360
16.00	-2.3600	17.00	-1.8560	18.00	-1.5720	19.00	-1.6700
20.00	-1.9370	21.00	-1.6890	22.00	-1.6550	23.00	-1.4430
24.00	-1.1670	25.00	-.9580	26.00	-.6680	27.00	-.3210
28.00	-.3660	29.00	-.2620	30.00	-.2570	31.00	-.2950
32.00	-.5050	33.00	-.5130	34.00	-.5570	35.00	-.5060
36.00	-.4710	37.00	-.4540	38.00	-.5170	39.00	-.6020
40.00	-.7630	41.00	-.8460	42.00	-.8460	43.00	-.8440
44.00	-.9300	45.00	-.9270	46.00	-.8680	47.00	-1.1450
48.00	-1.2370	49.00	-1.1790	50.00	-.9790	51.00	-.4910
52.00	.0380	53.00	.2780	54.00	.1650	55.00	.1790
56.00	.1250	57.00	.1550	58.00	.2880	59.00	.3630
60.00	.3230	61.00	.3630	62.00	.2540	63.00	.3870
64.00	.3710	65.00	.3470	66.00	.2100	67.00	.1680
68.00	.2670	69.00	.3170	70.00	.1390	71.00	.1340
72.00	.1930	73.00	.2110	74.00	.1790	75.00	.0570
76.00	.0820	77.00	.0310	78.00	-.0390	79.00	-.0380
80.00	-.0840	81.00	-.0130	82.00	.0870	83.00	.1130
84.00	.0870	85.00	.1340	86.00	.1000	87.00	.1670
87.00	.1670						
178	ANGLE OF	SIDESLIP VS.	TIME				
0.00	89.7470	1.00	14.1100	2.00	7.9870	3.00	6.0560
4.00	5.3080	5.00	4.9850	6.00	5.1630	7.00	4.6750
8.00	5.1750	9.00	4.7600	10.00	4.0910	11.00	3.3410
12.00	3.0260	13.00	3.0360	14.00	2.8550	15.00	2.4970
16.00	2.2130	17.00	2.1110	18.00	2.3110	19.00	2.4790
20.00	2.5510	21.00	2.4610	22.00	2.4920	23.00	2.5910
24.00	2.7410	25.00	2.8050	26.00	2.4510	27.00	2.2620
28.00	2.1530	29.00	1.9670	30.00	1.9040	31.00	1.7950
32.00	1.6760	33.00	1.4760	34.00	1.4080	35.00	1.4260
36.00	1.5100	37.00	1.7020	38.00	1.8110	39.00	1.7570
40.00	1.7520	41.00	1.7150	42.00	1.5160	43.00	1.3720

Figure 5 (continued)
Sample Problem Input - Angles of Attack and Sideslip

44.00	1.4230	45.00	1.3150	46.00	1.3570	47.00	1.3800
48.00	1.1540	49.00	1.1090	50.00	1.1360	51.00	1.0240
52.00	.8410	53.00	.9250	54.00	.8570	55.00	.9100
56.00	.7180	57.00	.5530	58.00	.2780	59.00	.1730
60.00	.1800	61.00	.1380	62.00	.0240	63.00	-.0720
64.00	-.1950	65.00	-.1640	66.00	-.1950	67.00	-.2610
68.00	-.3080	69.00	-.3340	70.00	-.3460	71.00	-.2830
72.00	-.3550	73.00	-.3080	74.00	-.2340	75.00	-.1330
76.00	-.2000	77.00	-.2640	78.00	-.3340	79.00	-.4740
80.00	-.5820	81.00	-.5830	82.00	-.4540	83.00	-.2070
84.00	-.4400	85.00	-.3590	86.00	-.3860	87.00	-.1360
87.00	-.1360						

Figure 5 (continued)
Sample Problem Input - Telemetered Data

```
    5         3
  582      PITCH RATE VS. TIME
  -.87      -.02     -.57      .01      -.27       .02       .03      -.16
   .33      -.12      .63      .01       .93       .08      1.23       .12
  1.53      -.14     1.83     -.73      2.13     -1.46      2.43     -2.21
  2.73     -2.83     3 03    -3.19      3.33     -3.26      3.63     -3.06
  3.93     -2.70     4.23    -2.27      4.53     -1.85      4.83     -1.57
  5.13     -1.43     5.43    -1.43      5.73     -1.56      6.03     -1.75
  6.33     -1.93     6.63    -1.87      6.93     -1.63      7.23     -1.27
  7.53      -.90     7.83     -.59      8.13      -.39      8.43      -.34
  8.73      -.40     9.03     -.57      9.33      -.73      9.63      -.92
  9.93     -1.10    10.23    -1.20     10.53     -1.19     10.83     -1.08
 11.13      -.92    11.43     -.85     11.73      -.76     12.03      -.82
 12.33      -.93    12.63     -.99     12.93     -1.01     13.23      -.97
 13.53      -.89    13.83     -.81     14.13      -.79     14.43      -.85
 14.73      -.95    15.03    -1.02     15.33     -1.08     15.63     -1.12
 15.93     -1.06    16.23     -.91     16.53      -.73     16.83      -.65
 17.13      -.70    17.43     -.83     17.73     -1.00     18.03     -1.13
 18.33     -1.17    18.63    -1.13     18.93     -1.04     19.23     -1.07
 19.53     -1.10    19.83    -1.01     20.13      -.76     20.43      -.60
 20.73      -.49    21.03     -.52     21.33      -.69     21.63      -.89
 21.93     -1.03    22.23    -1.08     22.53     -1.05     22.83     -1.10
 23.13     -1.32    23.43    -1.32     23.73     -1.20     24.03     -1.12
 24.33     -1.10    24.63    -1.15     24.93     -1.12     25.23     -1.00
 25.53      -.97    25.83     -.85     26.13      -.68     26.43      -.62
 26.73      -.84    27.03    -1.04     27.33     -1 17     27.63     -1.18
 27.93     -1.10    28.23    -1.04     28.53      -.96     28.83      -.78
 29.13      -.80    29.43     -.88     29.73      -.94     30.03      -.88
 30.33      -.86    30.63     -.84     30.93      -.79     31.23      -.83
 31.53      -.97    31.83     -.99     32.13      -.88     32.43      -.74
 32.73      -.78    33.03     -.87     33.33      -.93     33.63      -.90
 33.93      -.81    34.23     -.77     34.53      -.85     34.83      -.94
 35.13      -.97    35.43     -.91     35.73      -.86     36.03      -.83
 36.33      -.90    36.63     -.95     36.93      -.97     37.23      -.99
 37.53      -.90    37.83     -.76     38.13      -.75     38.43      -.90
```

Figure 5 (continued)
Sample Problem Input - Telemetered Data

38.73	-1.07	39.03	-1.05	39.33	-.98	39.63	-.95
39.93	-.85	40.23	-.82	40.53	-.81	40.83	-.64
41.13	-.50	41.43	.55	41.73	-.70	42.03	-.76
42.33	-.77	42.63	-.75	42.93	-.64	43.23	-.51
43.53	-.50	43.83	-.66	44.13	-.78	44.43	-.64
44.73	-.56	45.03	-.60	45.33	-.73	45.63	-.78
45.93	-.69	46.23	-.64	46.53	-.65	46.83	-.70
47.13	-.71	47.43	-.63	47.73	-.49	48.03	-.61
48.33	-.64	48.63	-.48	48.93	-.63	49.23	-.66
49.53	-.67	49.83	-.63	50.13	-.45	50.43	-.55
50.73	-.72	51.03	-.80	51.33	-.65	51.63	-.44
51.93	-.36	52.23	-.43	52.53	-.59	52.83	-.67
53.13	-.67	53.43	-.54	53.73	-.51	54.03	-.50
54.33	-.44	54.63	-.42	54.93	-.54	55.23	-.64
55.53	-.76	55.83	-.61	56.13	-.52	56.43	-.51
56.73	-.46	57.03	-.29	57.33	-.24	57.63	-.33
57.93	-.34	58.23	-.38	58.53	-.40	58.83	-.34
59.13	-.37	59.43	-.43	59.73	-.47	60.03	-.47
60.33	-.35	60.63	-.22	60.93	-.26	61.23	-.36
61.53	-.43	61.83	-.57	62.13	-.44	62.43	-.37
62.73	-.23	63.03	-.30	63.33	-.37	63.63	-.45
63.93	-.46	64.23	-.37	64.53	-.29	64.83	-.30
65.13	-.35	65.43	-.43	65.73	-.46	66.03	-.42
66.33	-.34	66.63	-.30	66.93	-.34	67.23	-.37
67.53	-.41	67.83	-.42	68.13	-.41	68.43	-.37
68.73	-.33	69.03	-.33	69.33	-.34	69.63	-.36
69.93	-.37	70.23	-.37	70.53	-.39	70.83	-.41
71.13	-.39	71.43	-.39	71.73	-.36	72.03	-.35
72.33	-.33	72.63	-.33	72.93	-.32	73.23	-.33
73.53	-.36	73.83	-.38	74.13	-.38	74.43	-.37
74.73	-.37	75.03	-.38	75.33	-.39	75.63	-.40
75.93	-.40	76.23	-.38	76.53	-.39	76.83	-.39
77.13	-.38	77.43	-.38	77.73	-.37	78.03	-.37
78.33	-.37	78.63	-.37	78.93	-.36	79.23	-.37
79.53	-.37	79.83	-.38	80.13	-.38	80.43	-.37
80.73	-.37	81.03	-.35	81.33	-.34	81.63	-.32
81.93	-.32	82.23	-.33	82.53	-.32	82.83	-.33
83.13	-.34	83.43	-.36	83.73	-.36	84.03	-.37
84.33	-.38	84.63	-.38	84.93	-.38	85.23	-.38
85.53	-.39	85.83	-.39	90.00	0.00		

Figure 5 (continued)
Sample Problem Input - Telemetered Data

582	PITCH CONTROL SURFACE DEFLECTION VS. TIME						
-.87	.04	-.57	.03	-.27	.04	.03	.09
.33	-.39	.63	-.70	.93	-.35	1.23	1.20
1.53	5.57	1.83	8.49	2.13	9.54	2.43	8.91
2.73	6.81	3.03	4.01	3.33	1.21	3.63	-.78
3.93	-1.91	4.23	-2.12	4.53	-1.29	4.83	.15
5.13	1.88	5.43	3.55	5.73	4.80	6.03	5.55
6.33	4.63	6.63	2.40	6.93	.75	7.23	.14
7.53	.25	7.83	1.19	8.13	2.58	8.43	4.03
8.73	5.22	9.03	5.94	9.33	6.25	9.63	6.30
9.93	5.91	10.23	5.16	10.53	4.48	10.83	4.07
11.13	4.00	11.43	4.25	11.73	4.62	12.03	5.02
12.33	5.07	12.63	4.86	12.93	4.70	13.23	4.54
13.53	4.52	13.83	4.72	14.13	5.07	14.43	5.32
14.73	5.34	15.03	5.19	15.33	4.85	15.63	4.34
15.93	3.93	16.23	3.84	16.53	4.11	16.83	4.87
17.13	5.48	17.43	5.74	17.73	5.70	18.03	5.19
18.33	4.59	18.63	4.08	18.93	3.83	19.23	3.71
19.53	3.25	19.83	2.86	20.13	2.94	20.43	3.86
20.73	4.88	21.03	5.77	21.33	6.37	21.63	6.47
21.93	6.21	22.23	5.70	22.53	5.42	22.83	5.23
23.13	4.43	23.43	3.26	23.73	2.65	24.03	2.37
24.33	2.11	24.63	1.66	24.93	1.17	25.23	.85
25.53	.83	25.83	.87	26.13	1.39	26.43	2.21
26.73	2.73	27.03	2.40	27.33	1.71	27.63	1.04
27.93	.60	28.23	.40	28.53	.24	28.83	.51
29.13	.88	29.43	1.04	29.73	.94	30.03	.90
30.33	.99	30.63	1.16	30.93	1.33	31.23	1.84
31.53	1.81	31.83	1.45	32.13	1.35	32.43	1.67
32.73	2.24	33.03	2.34	33.33	2.32	33.63	2.26
33.93	2.29	34.23	2.67	34.53	2.92	34.83	2.90
35.13	2.75	35.43	2.63	35.73	2.70	36.03	2.85
36.33	2.98	36.63	2.97	36.93	2.88	37.23	2.76
37.53	2.57	37.83	2.79	38.13	3.28	38.43	3.56
38.73	3.29	39.03	2.78	39.33	2.58	39.63	2.50

Figure 5 (continued)
Sample Problem Input - Telemetered Data

39.[illegible]	2.50	40.23	2.63	40.53	2.42	40.83	2.18
41.13	2.45	41.43	2.83	41.73	2.85	42.03	2.46
42.33	2.09	42.63	1.76	42.93	1.60	43.23	1.69
43.53	2.11	43.83	2.29	44.13	1.98	44.43	1.53
44.73	1.65	45.03	1.91	45.33	1.88	45.63	1.47
45.93	1.12	46.23	1.09	46.53	1.12	46.83	1.07
47.13	.89	47.43	.74	47.73	.83	48.03	1.04
48.33	.96	48.63	.91	48.93	1.16	49.23	.86
49.53	.51	49.83	.37	50.13	.42	50.43	.90
50.73	.80	51.03	.29	51.33	-.06	51.63	.16
51.93	.96	52.23	1.51	52.53	1.64	52.83	1.41
53.13	1.04	53.43	.83	53.73	.95	54.03	1.05
54.33	1.31	54.63	1.77	54.93	2.04	55.23	2.00
55.53	1.56	55.83	1.18	56.13	1.19	56.43	1.20
56.73	.99	57.03	1.00	57.33	1.34	57.63	1.78
57.93	1.78	58.23	1.79	58.53	1.78	58.83	1.74
59.13	1.85	59.43	1.88	59.73	1.74	60.03	1.50
60.33	1.36	60.63	1.49	60.93	2.02	61.23	2.11
61.53	2.08	61.83	1.76	62.13	1.26	62.43	1.27
62.73	1.48	63.03	1.91	63.33	1.95	63.63	1.87
63.93	1.61	64.23	1.44	64.53	1.57	64.83	1.86
65.13	1.92	65.43	1.90	65.73	1.69	66.03	1.57
66.33	1.58	66.63	1.70	66.93	1.87	67.23	1.90
67.53	1.87	67.83	1.78	68.13	1.68	68.43	1.65
68.73	1.66	69.03	1.80	69.33	1.86	69.63	1.89
69.93	1.90	70.23	1.89	70.53	1.89	70.83	1.81
71.13	1.73	71.43	1.70	71.73	1.69	72.03	1.71
72.33	1.81	72.63	1.89	72.93	2.01	73.23	2.15
73.53	2.21	73.83	2.21	74.13	2.20	74.43	2.19
74.73	2.19	75.03	2.20	75.33	2.18	75.63	2.14
75.93	2.08	76.23	2.06	76.53	2.07	76.83	2.05
77.13	2.01	77.43	2.00	77.73	2.00	78.03	2.02
78.33	2.03	78.63	2.02	78.93	2.04	79.23	2.08
79.53	2.09	79.83	2.10	80.13	2.09	80.43	2.09
80.73	2.10	81.03	2.14	81.33	2.20	81.[illegible]3	2.29
83.13	2.93	83.43	2.98	83.73	3.02	84.[illegible]3	3.04
84.33	3.05	84.63	3.04	84.93	3.03	85.23	3.01
85.53	2.98	85.83	2.96	90.00	0.00		

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Figure 5 (continued)
Sample Problem Input - Telemetered Data

5 3
582 YAW RATE VS. TIME

-.87	.04	-.57	.05	-.27	-.01	.03	-.02
.33	.02	.63	.11	.93	.16	1.23	.15
1 53	.14	1.83	.13	2.13	.15	2.43	.18
2.73	.11	3.03	.05	3.33	-.03	3.63	-.10
3.93	-.15	4.23	-.16	4.53	-.12	4.83	-.03
5.13	.06	5.43	.12	5.73	.17	6.03	.21
6.33	.22	6.63	.19	6.93	.13	7.23	.07
7.53	.01	7.83	-.01	8.13	.01	8.43	.05
8.73	.07	9.03	.06	9.33	.03	9.63	.07
9.93	.10	10.23	.13	10.53	.15	10.83	.09
11.13	-.03	11.43	-.02	11.73	-.01	12.03	-.04
12.33	-.09	12.63	-.06	12.93	.04	13.23	.12
13.53	.22	13.83	.33	14.13	.34	14.43	.36
14.73	.29	15.03	.16	15.33	-.00	15.63	-.09
15.93	-.10	16.23	-.09	16.53	-.07	16.83	-.04
17.13	.05	17.43	.14	17.73	.20	18.03	.24
18.33	.22	18.63	.13	18.93	.13	19.23	.16
19.53	.12	19.83	.03	20.13	-.02	20.43	.06
20.73	.23	21.03	.19	21.33	.05	21.63	-.03
21.93	-.08	22.23	-.07	22.53	.18	22.83	.47
23.13	.74	23.43	.48	23.73	.14	24.03	-.26
24.33	-.33	24.63	-.16	24.93	.01	25.23	.10
25.53	.22	83	.11	26.13	-.02	26.43	-.15
26.73	.06	.03	.21	27.33	.13	27.63	-.04
27.93	-.16	28.23	-.07	28.53	.14	28.83	.09
29.13	-.24	29.43	-.24	29.73	.01	30.03	.02
30.33	-.18	30.63	-.23	30.93	.02	31.23	.12
31.53	.13	31.83	.01	32.13	-.07	32.43	.08
32.73	.19	33.03	.08	33.33	.04	33.63	.01
33.93	-.03	34.23	-.10	34.53	-.06	34.83	.02
35.13	.09	35.43	-.02	35.73	-.06	36.03	-.06
36.33	-.08	36.63	-.02	36.93	-.00	37.23	-.01
37.53	-.01	37.83	.02	38.13	.03	38.43	.02

Figure 5 (continued)
Sample Problem Input - Telemetered Data

38.73	-.01	39.03	-.03	39.33	-.08	39.63	.03
39.93	.03	40.23	-.04	40.53	-.05	40.83	.01
41.13	.05	41.43	.04	41.73	-.02	42.03	-.06
42.33	-.06	42.63	-.08	42.93	-.03	43.23	.03
43.53	.03	43.83	-.04	44.13	-.09	44.43	-.03
44.73	-.01	45.03	.01	45.33	.02	45.63	-.01
45.93	-.06	46.23	-.10	46.53	-.08	46.83	-.07
47.13	.05	47.43	.13	47.73	.05	48.03	.02
48.33	-.04	48.63	-.15	48.93	-.03	49.23	.06
49.53	-.04	49.83	.03	50.13	.14	50.43	-.06
50.73	-.22	51.03	-.10	51.33	.28	51.63	.06
51.93	-.11	52.23	-.18	52.53	.09	52.83	.11
53.13	.13	53.43	.07	53.73	-.01	54.03	.06
54.33	-.01	54.63	-.08	54.93	-.02	55.23	.00
55.53	.04	55.83	.10	56.13	.02	56.43	.02
56.73	.11	57.03	.00	57.33	.07	57.63	.06
57.93	-.00	58.23	.01	58.53	-.00	58.83	.06
59.13	.07	59.43	-.04	59.73	-.01	60.03	.01
60.33	.02	60.63	.08	60.93	.04	61.23	.00
61.53	.04	61.83	-.02	62.13	.09	62.43	.08
62.73	.04	63.03	-.02	63.33	-.02	63.63	-.02
63.93	.01	64.23	-.02	64.53	.04	64.83	.04
65.13	.06	65.43	-.03	65.73	.01	66.03	.04
66.33	.05	66.63	.05	66.93	.02	67.23	-.00
67.53	-.01	67.83	-.03	68.13	.03	68.43	.04
68.73	.04	69.03	.05	69.33	.02	69.63	.04
69 93	.02	70.23	.04	70.53	.00	70.83	-.01
71.13	.01	71.43	-.01	71.73	.03	72.03	.03
72.33	.05	72.63	.07	72.93	.07	73.23	.06
73.53	.01	73.83	-.04	74.13	-.05	74.43	-.02
74.73	-.03	75.03	-.03	75.33	.00	75.63	-.01
75.93	-.00	76.23	-.02	76.53	-.01	76.83	.02
77.13	.05	77.43	.04	77.73	.04	78.03	.07
78.33	.10	78.63	.11	78.93	.13	79.23	.11
79.53	.10	79.83	.08	80.13	.05	80.43	.04
80.73	.01	81.03	-.01	81.33	-.02	81.63	-.04
81.93	-.05	82.23	-.05	82.53	-.04	82.83	-.04
83.13	-.04	83.43	-.03	83.73	-.02	84.03	-.01
84.33	.01	84.63	.03	84.93	.04	85.23	.06
85.53	.08	85.83	.09	90.00	0.00		

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Figure 5 (continued)
Sample Problem Input - Telemetered Data

582 YAW CONTROL SURFACE DEFLECTION VS. TIME

-.87	-.77	-.57	-.69	-.27	-.75	.03	-.85
.33	-.73	.63	-.49	.93	-.33	1.23	-.26
1.53	-.03	1.83	.20	2.13	.47	2.43	.82
2.73	.97	3.03	.84	3.33	.71	3.63	.40
3.93	.05	4.23	-.34	4.53	-.63	4.83	-.72
5.13	-.65	5.43	-.47	5.73	-.11	6.03	.22
6.33	.54	6.63	.95	6.93	1.18	7.23	1.24
7.53	1.13	7.83	1.00	8.13	.92	8.43	.95
8.73	1.11	9.03	1.20	9.33	1.13	9.63	1.19
9.93	1.41	10.23	1.62	10.53	1.96	10.83	2.13
11.13	2.03	11.43	1.69	11.73	1.63	12.03	1.51
12.33	1.18	12.63	1.01	12.93	.99	13.23	1.25
13.53	1.69	13.83	2.41	14.13	3.16	14.43	3.80
14.73	4.40	15.03	4.62	15.33	4.53	15.63	4.20
15.93	3.80	16.23	3.58	16.53	3.30	16.83	3.13
17.13	3.06	17.43	3.30	17.73	3.66	18.03	4.18
18.33	4.62	18.63	4.82	18.93	4.91	19.23	5.09
19.53	5.32	19.83	5.34	20.13	5.18	20.43	4.91
20.73	5.44	21.03	6.04	21.33	6.05	21.63	5.85
21.93	5.51	22.23	5.19	22.53	5.21	22.83	6.25
23.13	8.03	23.43	9.40	23.73	9.53	24.03	8.46
24.33	7.32	24.63	6.77	24.93	6.78	25.23	7.02
25.53	7.56	25.83	7.85	26.13	7.75	26.43	7.20
26.73	6.89	27.03	7.43	27.33	7.84	27.63	7.71
27.93	7.10	28.23	6.67	28.53	6.93	28.83	7.27
29.13	6.81	29.43	5.77	29.73	5.70	30.03	5.89
30.33	5.62	30.63	4.70	30.93	4.51	31.23	5.09
31.53	5.29	31.83	5.39	32.13	4.94	32.43	4.93
32.73	5.26	33.03	5.68	33.33	5.46	33.63	5.42
33.93	5.31	34.23	5.04	34.53	4.70	34.83	4.64
35.13	4.78	35.43	4.77	35.73	4.44	36.03	4.21
36.33	3.89	36.63	3.72	36.93	3.72	37.23	3.65
37.53	3.50	37.83	3.37	38.13	3.41	38.43	3.42
38.73	3.31	39.03	3.08	39.33	2.84	39.63	2.72

Figure 5 (continued)
Sample Problem Input - Telemetered Data

39.93	2.81	40.23	2.66	40.53	2.35	40.83	2.25
41.13	2.26	41.43	2.33	41.73	2.30	42.03	2.05
42.33	1.87	42.63	1.66	42.93	1.44	43.23	1.46
43.53	1.45	43.83	1.44	44.13	1.06	44.43	.89
44.73	.82	45.03	.74	45.33	.75	45.63	.73
45.93	.64	46.23	.42	46.53	-.02	46.83	-.19
47.13	-.40	47.43	-.09	47.73	.14	48.03	.14
48.33	.03	48.63	-.15	48.93	-.57	49.23	-.41
49.53	-.38	49.83	-.74	50.13	-.22	50.43	-.04
50.73	-.72	51.03	-1.53	51.33	-.79	51.63	-.20
51.93	-.56	52.23	-1.24	52.53	-1.63	52.83	-1.07
53.13	-.92	53.43	-.72	53.73	-.74	54.03	-.68
54.33	-.51	54.63	-.73	54.93	-1.06	55.23	-.95
55.53	-1.22	55.83	-.73	56.13	-.71	56.43	-.88
56.73	-.85	57.03	-.68	57.33	-.75	57.63	-.74
57.93	-.38	58.23	-.59	58.53	-.71	58.83	-.61
59.13	-.10	59.43	-.20	59.73	-.38	60.03	-.38
60.33	-.49	60.63	-.43	60.93	-.26	61.23	-.36
61.53	-.20	61.83	-.52	62.13	-.37	62.43	-.17
62.73	-.00	63.03	-.16	63.33	-.31	63.63	-.28
63.93	-.50	64.23	-.54	64.53	-.57	64.83	-.45
65.13	-.35	65.43	-.45	65.73	-.57	66.03	-.49
66.33	-.47	66.63	-.36	66.93	-.28	67.23	-.36
67.53	-.46	67.83	-.50	68.13	-.64	68.43	-.56
68.73	-.52	69.03	-.47	69.33	-.44	69.63	-.49
69.93	-.53	70.23	-.57	70.53	-.55	70.83	-.64
71.13	-.69	71.43	-.76	71.73	-.80	72.03	-.80
72.33	-.78	72.63	-.65	72.93	-.52	73.23	-.40
73.53	-.41	73.83	-.58	74.13	-.80	74.43	-.92
74.73	-.99	75.03	-1.12	75.33	-1.20	75.63	-1.20
75.93	-1.31	76.23	-1.35	76.53	-1.44	83	-1.49
77.13	-1.44	77.43	-1.32	77.73	-1.34	78.03	-1.24
78.33	-1.08	78.63	-.91	78.93	-.66	79.23	-.42
79.53	-.32	79.83	-.20	80.13	-.20	80.43	-.17
80.73	-.20	81.03	-.32	81.33	-.45	81.63	-.55
81.93	-.77	82.23	-.95	82.53	-1.06	82.83	-1.13
83.13	-1.27	83.43	-1.40	83.73	-1.49	84.03	-1.56
84.33	-1.61	84.63	-1.58	84.93	-1.52	85.23	-1.43
85.53	-1.27	85.83	-1.13	90.00	0.00		

Figure 5 (continued)
Sample Problem Input - Telemetered Data

5	3						
582	ROLL RATE VS. TIME						
-.87	-.00	-.57	-.01	-.27	-.01	.03	.13
.33	.52	.63	.73	.93	.39	1.23	-.02
1.53	-.13	1.83	-.21	2.13	-.58	2.43	-.62
2.73	-.05	3.03	.02	3.33	-.11	3.63	-.26
3.93	.03	4.23	.39	4.53	.61	4.83	.44
5.13	.09	5.43	-.01	5.73	.01	6.03	.00
6.33	-.14	6.63	-.22	6.93	-.11	7.23	-.26
7.53	-.13	7.83	.07	8.13	.22	8.43	.15
8.73	.11	9.03	.04	9.33	-.18	9.63	-.02
9.93	.15	10.23	.20	10.53	.13	10.83	.08
11.13	.07	11.43	.04	11.73	.09	12.03	-.10
12.33	-.27	12.63	-.11	12.93	.03	13.23	.09
13.53	.07	13.83	.01	14.13	.02	14.43	.03
14.73	-.01	15.03	-.04	15.33	-.07	15.63	.02
15.93	.04	16.23	-.03	16.53	.03	16.83	-.06
17.13	-.14	17.43	-.09	17.73	-.07	18.03	-.06
18.33	-.05	18.63	-.05	18.93	-.03	19.23	-.09
19.53	-.06	19.83	-.01	20.13	.06	20.43	.13
20.73	.06	21.03	-.12	21.33	-.23	21.63	-.03
21.93	-.10	22.23	-.12	22.53	-.01	22.83	-.01
23.13	.02	23.43	-.09	23.73	-.03	24.03	-.17
24.33	-.10	24.63	-.04	24.93	-.13	25.23	.03
25.53	.05	25.83	.06	26.13	-.02	26.43	-.14
26.73	-.14	27.03	-.29	27.33	-.17	27.63	-.03
27.93	.03	28.23	.17	28.53	.05	28.83	.01
29.13	-.02	29.43	.05	29.73	-.18	30.03	-.11
30.33	-.09	30.63	-.09	30.93	-.03	31.23	.04
31.53	-.08	31.83	-.03	32.13	-.05	32.43	.09
32.73	.01	33.03	.08	33.33	-.06	33.63	.05
33.93	.02	34.23	.03	34.53	-.04	34.83	.03
35.13	.02	35.43	.09	35.73	-.00	36.03	-.02
36.33	-.02	36.63	.02	36.93	.03	37.23	.10
37.53	.09	37.83	.12	38.13	-.02	38.43	-.07
38.73	.00	39.03	-.02	39.33	.00	39.63	-.06

Figure 5 (continued)
Sample Problem Input - Telemetered Data

39.93	-.01	40.23	.01	40.53	-.07	40.83	-.02
41.13	-.09	41.43	-.03	41.73	-.13	42.03	-.07
42.33	-.08	42.63	-.10	42.93	-.05	43.23	-.04
43.53	-.09	43.83	-.03	44.13	-.08	44.43	-.09
44.73	-.05	45.03	-.11	45.33	-.14	45.63	-.13
45.93	-.07	46.23	-.04	46.53	-.07	46.83	-.18
47.13	-.15	47.43	-.11	47.73	.01	48.03	.05
48.33	-.05	48.63	.02	48.93	-.24	49.23	-.09
49.53	-.06	49.83	-.04	50.13	-.01	50.43	-.04
50.73	-.15	51.03	-.13	51.33	-.17	51.63	-.13
51.93	-.10	52.23	-.15	52.53	-.15	52.83	-.16
53.13	.02	53.43	-.08	53.73	.01	54.03	.09
54.33	-.30	54.63	.11	54.93	-.29	55.23	.06
55.53	-.11	55.83	-.11	56.13	-.06	56.43	.05
56.73	-.11	57.03	-.21	57.33	-.26	57.63	.08
57.93	-.10	58.23	-.07	58.53	-.03	58.83	-.07
59.13	.18	59.43	-.04	59.73	-.23	60.03	-.03
60.33	-.23	60.63	.01	60.93	.00	61.23	-.31
61.53	.07	61.83	-.11	62.13	-.08	62.43	-.21
62.73	.04	63.03	-.12	63.33	-.09	63.63	-.06
63.93	-.16	64.23	-.08	64.53	-.07	64.83	-.10
65.13	-.05	65.43	-.08	65.73	-.18	66.03	-.07
66.33	-.11	66.63	-.07	66.93	.02	67.23	-.13
67.53	-.11	67.83	.01	68.13	-.08	68.43	-.06
68.73	.03	69.03	-.06	69.33	-.04	69.63	.06
69.93	-.04	70.23	-.11	70.53	-.01	70.83	.03
71.13	-.01	71.43	.02	71.73	-.03	72.03	-.03
72.33	-.07	72.63	-.06	72.93	.03	73.23	.03
73.53	.02	73.83	-.00	74.13	-.06	74.43	-.04
74.73	.07	75.03	.06	75.33	-.05	75.63	.02
75.93	.05	76.23	.06	76.53	-.02	76.83	-.11
77.13	-.10	77.43	.00	77.73	.02	78.03	-.05
78.33	-.09	78.63	-.11	78.93	-.07	79.23	-.00
79.53	.02	79.83	.02	80.13	-.02	80.43	-.06
80.73	-.04	81.03	-.03	81.33	-.04	81.63	-.02
81.93	-.02	82.23	-.05	82.53	-.05	82.83	-.03
83.13	-.04	83.43	-.04	83.73	-.04	84.03	-.03
84.33	-.01	84.63	-.01	84.93	-.01	85.23	.01
85.53	.02	85.83	.00	90.00	0.00		

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Figure 5 (continued)
Sample Problem Input - Telemetered Data

582	ROLL CONTROL SURFACE DEFLECTION VS. TIME						
-.87	.24	-.57	.25	-.27	.24	.03	.36
.33	1.10	.63	2.03	.93	2.29	1.23	2.02
1.53	1.78	1.83	1.65	2.13	1.06	2.43	.41
2.73	.48	3.03	.85	3.33	.72	3.63	.39
3.93	.38	4.23	.93	4.53	1.65	4.83	2.18
5.13	2.16	5.43	1.96	5.73	2.03	6.03	2.06
6.33	1.88	6.63	1.59	6.93	1.58	7.23	1.33
7.53	1.18	7.83	1.31	8.13	1.62	8.43	1.85
8.73	1.94	9.03	1.97	9.33	1.77	9.63	1.69
9.93	1.91	10.23	2.18	10.53	2.37	10.83	2.40
11.13	2.44	11.43	2.44	11.73	2.58	12.03	2.53
12.33	2.13	12.63	2.05	12.93	2.16	13.23	2.37
13.53	2.52	13.83	2.49	14.13	2.55	14.43	2.61
14.73	2.61	15.03	2.56	15.33	2.51	15.63	2.55
15.93	2.63	16.23	2.64	16.53	2.66	16.83	2.68
17.13	2.56	17.43	2.46	17.73	2.47	18.03	2.43
18.33	2.46	18.63	2.41	18.93	2.44	19.23	2.37
19.53	2.33	19.83	2.32	20.13	2.47	20.43	2.67
20.73	2.82	21.03	2.71	21.33	2.46	21.63	2.38
21.93	2.47	22.23	2.25	22.53	2.38	22.83	2.45
23.13	2.63	23.43	2.48	23.73	2.48	24.03	2.29
24.33	2.24	24.63	2.30	24.93	2.24	25.23	2.27
25.53	2.46	25.83	2.52	26.13	2.56	26.43	2.39
26.73	2.35	27.03	2.04	27.33	1.90	27.63	1.99
27.93	2.10	28.23	2.33	28.53	2.47	28.83	2.43
29.13	2.39	29.43	2.51	29.73	2.43	30.03	2.24
30.33	2.23	30.63	2.16	30.93	2.20	31.23	2.29
31.53	2.24	31.83	2.20	32.13	2.26	32.43	2.36
32.73	2.45	33.03	2.49	33.33	2.56	33.63	2.55
33.93	2.68	34.23	2.72	34.53	2.70	34.83	2.74
35.13	2.76	35.43	2.86	35.73	2.93	36.03	2.97
36.33	2.94	36.63	2.99	36.93	3.05	37.23	3.14
37.53	3.29	37.83	3.45	38.13	3.49	38.43	3.43
38.73	3.47	39.03	3.46	39.33	3.49	39.63	3.54
39.93	3.49	40.23	3.62	40.53	3.45	40.83	3.51

Figure 5 (continued)
Sample Problem Input - Telemetered Data

41.13	3.50	41.43	3.46	41.73	3.47	42.03	3.32
42.33	3.38	42.63	3.26	42.93	3.30	43.23	3.37
43.53	3.26	43.83	3.32	44.13	3.18	44.43	3.23
44.73	3.14	45.03	3.19	45.33	3.05	45.63	3.02
45.93	2.96	46.23	2.97	46.53	2.95	46.83	2.85
47.13	2.71	47.43	2.72	47.73	2.77	48.03	2.87
48.33	2.82	48.63	2.95	48.93	2.83	49.23	2.70
49.53	2.75	49.83	2.73	50.13	2.85	50.43	2.85
50.73	2.59	51.03	2.53	51.33	2.58	51.63	2.38
51.93	2.27	52.23	2.29	52.53	2.26	52.83	2.09
53.13	2.22	53.43	2.28	53.73	2.26	54.03	2.44
54.33	2.22	54.63	2.24	54.93	2.07	55.23	2.28
55.53	2.11	55.83	2.36	56.13	2.10	56.43	2.31
56.73	2.35	57.03	2.27	57.33	1.93	57.63	2.11
57.93	2.13	58.23	2.13	58.53	2.08	58.83	2.34
59.13	2.56	59.43	2.54	59.73	2.35	60.03	2.36
60.33	2.26	60.63	2.27	60.93	2.45	61.23	2.23
61.53	2.30	61.83	2.31	62.13	2.40	62.43	2.23
62.73	2.26	63.03	2.33	63.33	2.19	63.63	2.33
63.93	2.15	64.23	2.20	64.53	2.22	64.83	2.25
65.13	2.19	65.43	2.22	65.73	2.05	66.03	2.06
66.33	2.06	66.63	1.99	66.93	2.04	67.23	2.09
67.53	1.96	67.83	2.00	68.13	2.09	68.43	1.95
68.73	1.99	69.03	2.01	69.33	1.97	69.63	2.04
69.93	2.07	70.23	1.96	70.53	1.90	70.83	1.99
71.13	2.00	71.43	1.99	71.73	1.97	72.03	1.93
72.33	1.89	72.63	1.80	72.93	1.84	73.23	1.92
73.53	1.94	73.83	1.95	74.13	1.90	74.43	1.85
74.73	1.91	75.03	2.04	75.33	2.04	75.63	2.00
75.93	2.12	76.23	2.21	76.53	2.20	76.83	2.13
77.13	2.00	77.43	2.05	77.73	2.16	78.03	2.14
78.33	2.03	78.63	1.96	78.93	1.96	79.23	1.98
79.53	2.06	79.83	2.10	80.13	2.12	80.43	2.05
80.73	2.03	81.03	2.03	81.33	2.02	81.63	2.06
81.93	2.06	82.23	2.00	82.53	2.00	82.83	2.02
83.13	2.02	83.43	1.98	83.73	1.97	84.03	2.02
84.33	2.05	84.63	2.07	84.93	2.09	85.23	2.13
85.53	2.19	85.83	2.20	90.00	0.00		

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Figure 5 (continued)
Sample Problem Input - Single Constants, Time Increments and CALCOMP Plot Input Data

```
     -0.05    -0.033     0.317      824.    853.45      497.      849.      4.14
      1.25     269.8      5.25      2.58 0.5045E-6        0.
         1                    NUMBER OF TIME GROUPS FOR OUTPUT INTERVAL
      86.3       0.5
SCOUT FIRST STAGE DISTURBING MOMENTS - SAMPLE PROBLEM
         5     S-192
*EOR
```

Figure 6
Sample Problem Output

RUN NO. 1
S-162 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34--40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - PITCH CHANNEL

PAGE NO. 1

TIME (SEC)	DELTA-M (FT-LB)	M(AERO) (FT-LB)	M(CONTRL) (FT-LB)	M(I) (FT-LB)	M(JD) (FT-LB)	M(CG) (FT-LB)	M(ETFLX) (FT-LB)	M(PRIME) (FT-LB)	ET(FLX) (DEG)	ET(RIGID) (DEG)	ET(PRIME) (DEG)	(XCG-XCP) (FT)
0.00	-2461.	-0	-0.	-2461.	0.	-0.	0.	-2461.	-.000	0.000	0.000	5.202
.50	4431.	-3908.	1901.	2676.	15.	629.	-493.	5078.	-.009	.083	.095	5.551
1.00	678.	259.	-34.	1193.	-26.	540.	-224.	1197.	-.005	.015	.028	-.611
1.50	2351.	687.	-14111.	-10122.	31.	513.	408.	2001.	.009	.054	.067	-1.538
2.00	2620.	1589.	-24153.	-18286.	308.	498.	853.	3434.	.020	.063	.082	-3.677
2.50	1417.	2524.	-21827.	-16093.	622.	488.	684.	2537.	.017	.035	.062	-4.790
3.00	94.	3402.	-10901.	-5944.	823.	481.	157.	1410.	.004	.002	.035	-5.885
3.50	576.	3952.	-205.	5249.	810.	474.	-358.	1875.	-.009	.015	.047	-6.065
4.00	743.	4383.	4815.	10455.	665.	471.	-622.	1896.	-.016	.019	.048	-6.232
4.50	543.	4744.	3345.	8988.	483.	470.	-598.	1516.	-.015	.014	.039	-6.574
5.00	211.	5169.	-2730.	3121.	380.	470.	-370.	1082.	-.010	.005	.028	-6.816
5.50	23.	6058.	-9231.	-2535.	372.	469.	-180.	843.	-.005	-.001	.022	-7.159
6.00	97.	7001.	-13088.	-5170.	440.	468.	-88.	1035.	-.002	.003	.027	-7.397
6.50	1261.	7994.	-3007.	1833.	481.	467.	-363.	2242.	-.009	.033	.058	-7.715
7.00	549.	8796.	-1438.	8073.	391.	466.	-692.	1444.	-.018	.014	.038	-7.959
7.50	104.	9216.	-568.	8483.	237.	465.	-763.	640.	-.020	-.003	.017	-8.127
8.00	-536.	9581	-4715.	4292.	120	464.	-623.	94.	-.016	-.014	.002	-8.282
8.50	947.	9910.	-10309.	-1172.	89.	463.	-379.	-345.	-.010	-.025	-.009	-8.776
9.00	-448.	10157.	-14097.	-3982.	139.	462.	-196.	208.	-.005	-.012	.005	-9.263
9.50	-497.	10453.	-15143.	-4662.	210.	462.	-146.	233.	-.004	-.013	.006	-9.496
10.00	95	10607.	-13889.	-2316.	281.	461.	-179.	708.	-.005	-.003	.019	-9.706
10.50	861.	11148.	-11141.	1319.	292.	461.	-309.	1689.	-.008	.023	.045	-9.880
11.00	1151.	11419.	-10000.	2916.	248.	463.	-364.	1938.	-.010	.031	.052	-10.054
11.50	616.	11434.	-10899.	1556.	209.	464.	-327.	1371.	-.009	.016	.036	-10.181
12.00	-1364.	11367.	-12679.	-2249.	205.	465.	-243.	-604.	-.006	-.036	-.016	-10.193
12.50	1067.	11968.	-12770.	-1433.	244.	467.	-274.	-261.	-.007	-.028	-.007	-10.190
13.00	30	12467.	-12194.	696.	254.	469.	-329.	856.	-.009	.001	.023	-10.188
13.50	871.	12853.	-12002.	2058.	229.	471.	-365.	1682.	-.010	.023	.044	-10.223
14.00	154.	13215.	-13248.	151.	204.	474.	-340.	642.	-.009	-.004	.017	-10.274
14.50	[illegible]	13405.	-14555.	-1966.	224.	476.	-292.	-399.	-.008	-.032	-.010	-10.329
15.00	1092.	13564.	-14440.	-1522.	261.	479.	-295.	-219.	-.008	-.028	-.006	-10.384
15.50	-1858.	13785.	-12902.	-569.	286.	481.	-359.	-949.	-.009	-.048	-.025	-10.434
16.00	435.	13778	-11275.	3332.	267.	483.	-420.	1401.	-.011	.013	.036	-10.485
16.50	1916.	13166.	-11974.	3435.	135.	484.	-351.	2758.	-.009	.049	.071	-10.534
17.00	1194.	12520.	-15528.	-1310.	176.	483.	-155.	2028.	-.004	.031	.052	-10.583
17.50	353.	12551.	-17321.	-3777.	225.	482.	-68.	1246.	-.002	.009	.032	-10.623
18.00	692.	12555.	-16093.	-2169.	289.	481.	-94.	1659.	-.002	.018	.043	-10.681
18.50	860.	13583.	-13418.	1538.	297.	481.	-264.	1845.	-.007	.022	.048	10.735
19.00	-3196.	14543.	-12052.	-333.	271.	480.	-384.	-2227.	-.010	-.083	-.058	-10.790
19.50	-5835.	16408.	-10616.	165.	283.	480.	-556.	-4842.	-.015	-.153	-.127	-10.908
20.00	-3931.	18290.	-9503.	4840.	224.	479.	-720.	-2985.	-.019	-.103	-.078	-11.097
20.50	-1889.	18162.	-13632.	2726.	148.	478.	-541.	-1008.	-.014	-.050	-.027	-11.302
21.00	-1397.	18123.	-19220.	-2186.	133.	476.	-301	-519.	-.008	-.037	-.014	-11.506
21.50	-1941.	19315.	-22114.	-4288.	206.	475.	-222.	-978.	-.006	-.051	-.026	-11.705
22.00	-663.	20481.	-21356.	-1092.	267.	475.	-296.	375.	-.008	-.018	.010	-11.903
22.50	-383.	20422.	-19483.	358.	271.	476.	-345.	74.	-.009	-.026	.002	-12.10[illegible]
23.00	-6788.	20392.	-17422.	-3418.	316.	478.	-394.	-5670.	-.010	-.179	-.149	-12.299
23.50	-6468.	19752.	-11597.	1644.	334.	479.	-557.	-5316.	-.015	-.170	-.140	-12.496
24.00	-8546.	18713.	-9098.	1272.	293.	480.	-577.	-7419.	-.015	-.224	-.194	-12.691
24.50	-11846.	18129.	-7188.	-723.	294.	483.	-598.	-10698.	-.016	-.308	-.279	-12.887

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Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 2

S-192 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34/-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - PITCH CHANNEL (CONTINUED)

TIME (SEC)	M(ALPHA) (FT-LB)	M(O) (FT-LB)	M(CFIN) (FT-LB)	M(DAMP) (FT-LB)	CM(PRED)	CM(EFF)	XCP(PRED)P (IN)	XCP(EFF)P (IN)	ET(EFF)P (DEG)	LD(EFF)P (LB/DEG)	LD(PRED) (LB/DEG)
0.00	-0.	0.	0.	0.	-84.1787	**********	474.57	**********	-.000	548.877	0.000
.50	-3834.	18.	2.	6.	-62.6004	10.1008	469.87	546.86	.074	211.730	63.442
1.00	234.	37.	4.	-16.	2.2177	7.7834	543.09	564.36	.010	-1043.845	54.513
1.50	603.	55.	6.	23.	3.5973	16.4518	553.55	626.50	.064	42.678	51.309
2.00	1262.	73.	8.	245.	5.4771	10.2244	578.56	670.15	.083	43.[illegible]03	49.328
2.50	1892.	91.	10.	530.	6.5067	11.1547	591.30	634.34	.061	44.651	47.809
3.00	2544	110.	13.	736.	7.2557	7.5125	603.82	606.43	.006	46.164	46.575
3.50	3065.	128.	15.	754.	7.4592	8.8097	605.36	619.09	.006	-85.516	45.355
4.00	3583.	146.	17.	637.	7.6486	9.1713	606.77	622.27	.003	51.563	44.479
4.50	4088.	165.	19.	472.	7.7527	8.7424	610.29	620.77	-.001	51.177	43.810
5.00	458[illegible].	183.	21.	378.	7.8251	8.1707	613.82	617.63	-.004	39.680	43.145
5.50	5404.	217.	25.	412.	7.7709	7.7390	616.16	615.79	-.005	42.597	42.486
6.00	6189.	251.	29.	531.	7.6938	7.8103	618.44	610.84	.000	41.500	41.830
6.50	7051.	285.	33.	625.	7.7162	9.0415	621.67	638.23	.023	34.250	41.180
7.00	7895.	319.	37.	541.	7.7187	8.2345	624.82	630.66	-.004	23.846	40.533
7.50	8475.	354.	42.	346.	7.4923	7.4044	626.46	624.27	-.023	48.236	40.25
8.00	8964.	388.	46.	184.	7.2372	6.8280	626.74	620.79	-.030	44.961	39.976
8.50	9236.	422.	50.	142.	6.9119	6.2382	632.10	621.37	-.025	43.734	39.695
9.00	9417.	456.	54.	230.	6.4966	6.2019	637.39	632.11	-.017	40.822	39.423
9.50	9545.	490.	58.	360.	6.1430	5.8385	639.64	633.70	-.017	40.602	39.152
10.00	9523.	524.	63.	497.	5.7499	5.6963	641.61	640.44	-.007	39.185	38.881
10.50	9943.	579.	69.	557.	5.4549	5.9010	643.15	653.41	.015	35.265	38.717
11.00	10224.	633.	76.	486.	5.1447	5.6000	644.69	658.26	.021	33.418	38.618
11.50	10298.	688.	83.	426.	4.7932	5.0619	645.67	652.97	.008	35.938	38.520
12.00	10101.	742.	90.	435.	4.3839	3.8324	645.26	628.74	-.043	43.396	38.482
12.50	10542.	796.	97.	534.	4.2708	3.8688	644.68	632.30	-.036	42.231	38.383
13.00	10941.	851.	103.	572.	4.1573	4.1680	644.10	644.44	-.008	38.155	38.272
[illegible]	11308.	905.	111.	549.	4.0472	4.3359	643.98	653.44	.013	34.767	38.248
[illegible]	11653.	960.	118.	484.	3.9423	3.8942	644.06	642.[illegible]2	-.013	38.789	38.225
[illegible]50	11722.	1014.	125.	543.	3.7672	3.4050	644.17	631.22	-.040	42.342	38.201
15.00	11717.	1069.	133.	645.	3.5892	3.2826	644.29	632.67	-.036	41.949	38.178
15.50	11768	1144.	143.	730.	3.3863	2.8980	644.35	624.57	-.067	45.466	38.154
16.00	11703.	1217.	154.	703.	3.1801	3.3026	644.41	649.76	.002	35.848	38.130
16.50	111[illegible]0.	1292.	164.	530.	2.8909	3.3350	644.46	666.12	.040	29.570	37.864
17.00	10491.	1359.	175.	495.	2.5561	2.8577	644.51	668.[illegible]	.027	33.622	37.712
17.50	10287.	1425.	[illegible]	653.	2.4324	2.5058	644.47	648.85	.007	36.361	37.460
18.00	[illegible]	1491.	[illegible]	861.	2.2696	2.4063	644.42	653.29	.016	34.858	37.209
18.50	10912.	1556.	202.	987.	2.3452	2.5070	644.33	654.48	.016	33.409	36.959
19.00	118[illegible]3.	1619.	213.	848.	2.4218	1.8477	644.23	608.35	-.093	51.603	36.710
19.50	13588.	1682.	230.	908.	2.6248	1.6217	644.91	588.69	-.167	67.757	36.461
20.00	15570.	1745.	242.	733.	2.8533	2.2056	646.43	612.82	-.122	60.052	36.189
20.50	15593.	1812.	256.	496.	2.7455	2.4476	648.15	631.73	-.064	44.016	35.903
21.00	15[illegible]	1878.	269.	456.	2.6300	[illegible]4188	649.86	637.43	-.045	39.936	35.618
21.50	163[illegible]	1943.	282.	722.	2.6579	2.3761	651.51	634.85	-.057	40.628	35.334
22.00	17223	2008.	296.	954.	2.6849	2.5823	653.15	647.65	-.025	37.067	35.162
22.50	17207.	2023.	310.	981.	2.5726	2.4404	654.80	646.45	-.035	38.208	35.059
23.00	16883.	2024.	324.	1161.	2.4523	1.5720	656.44	587.11	-.189	59.698	34.956
23.50	16143.	2020.	339.	1245.	2.2758	1.4656	658.07	598.02	-.184	70.898	34.853
24.00	15250.	2010.	354.	1104.	2.0004	1.0654	659.69	574.35	-.239	98.537	34.750
24.50	14642.	1995.	370.	1181.	1.9503	.5617	661.32	536.20	-.324	145.246	34.756

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Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 3
S-192 POST FLIGHT FIRST STAGE MOMENT: NOVA I
ALGOL III SCOUT S-1 34/-40 HEATSHIEL.
CLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - PITCH CHANNEL

TIME SEC)	DELTA-M (FT-LB)	M(AERO. (FT-LB)	M(CONTRL) (FT-LB)	M(1) (FT-LB)	M(JD) (FT-LB)	M(CG) (FT-LB)	M(ETFLX) (FT-LB)	M(PRIME) (FT-LB)	ET(FLX) (DEG)	ET(RIGID) (DEG)	ET(PRIME) (DEG)	(XCG-XCP) (FT)
25.00	-11764.	17392.	-4335.	1417.	287.	487.	-661.	-10603.	-.017	-.304	-.274	-13.141
25.50	-11[illegible]8.	15952.	-3367.	1322.	258.	490.	-592.	[illegible]265.	-.015	-.203	-.263	-13.624
26.00	-5756.	14107.	-4818.	3803.	201.	493.	-429.	4638.	-.011	-.146	-.118	-14.113
26.50	-5490.	11561.	-9857.	-3196.	181.	496.	-87.	43[illegible]0.	-.002	-.138	-.110	-14.606
27.00	-3275	9046.	-10510.	-3869.	277.	498.	96.	-2036.	.002	-.082	-.051	-15.104
27.50	-4593.	9964.	-5837.	236.	321.	501	-120.	-3287.	-.003	-.114	-.082	-15.486
28.00	-7641.	10720.	-2452.	1143.	293.	504.	-286.	-6334.	-.007	-.188	-.156	-15.764
28.50	-5981.	9805.	-1144.	3163.	269.	507.	-291.	-4682.	-.007	-.146	-.114	-16.014
29.00	-6505.	8639.	-3230.	-521.	221.	510.	-157.	-5289.	-.004	-.158	-.127	-16.082
29.50	-5775.	8871.	-4579.	-822.	252.	513.	-104.	-4445.	-.003	-.139	-.107	-16.147
30.00	-4536.	9002.	-4095.	1012.	252.	516.	-127.	-3194.	-.003	-.108	-.076	-16.212
30.50	-4424.	9645.	-4942.	921.	243.	519.	119.	-3082.	-.003	-.105	-.073	-16.282
31.00	-5320.	10208.	-6616.	-1054.	230.	522.	-78.	-3984.	-.002	-.125	-.094	-16.203
31.50	-7696.	13155.	-8303.	-2183.	278.	524.	-140.	-6306.	-.003	-.180	-.147	-16.040
32.00	-6994.	15796.	-6396.	2848.	272.	527.	-357.	-5609.	-.008	-.162	-.130	-15.733
32.50	-7819.	15600.	-8290.	-49.	221.	530.	-292.	-6486.	-.007	-.180	-.149	-15.337
33.00	-[illegible]381.	15687.	-10724.	-1834.	256.	533.	-205.	-6017.	-.005	-.168	-.137	-14.936
33.50	5153.	16129.	-10524.	1009.	273.	536.	-253.	-3776.	-.006	-.117	-.085	-14.627
34.00	5116.	16277.	-10945.	721.	242.	539.	-276.	-3769.	-.006	-.115	-.085	-14.017
34.50	-4714.	15381.	-13306.	-1992.	256.	542.	-152.	-3348.	-.003	-.105	-.075	-13.464
35.00	-2528.	14642.	-12914.	-109.	293.	545.	-146.	-1122.	-.003	-.056	-.025	-12.891
35.50	-1096.	13821.	-12060.	1319.	277.	549.	-172.	296.	-.004	-.024	.006	-12.185
36.00	1198.	13042.	-12[illegible]16.	-384.	259.	552.	-183.	177.	-.003	-.026	.004	-11.470
36.50	-687.	12637.	-13557.	-853.	291.	556.	-94.	784.	-.002	-.015	.016	-10.777
37.00	-137.	12222.	-13015.	-179.	309.	562.	-119.	1298.	-.003	-.003	.028	-10.112
37.50	1334.	12514.	-11822	2651.	291.	568.	234.	2755.	-.005	.028	.068	-9.576
38.00	160.	12721.	-14008.	-511.	244.	574.	-201.	1530.	-.004	.003	.032	-9.102
38.50	-883.	13349.	-15961.	-2756.	307.	580.	-198.	563.	-.004	-.018	.012	-8.631
39.00	-457.	13979.	-12908.	1123.	348.	586.	-425.	1033.	-.009	-.009	.081	-8.159
39.50	-2336.	14909.	-11637.	1303.	322.	592.	-645.	-866.	-.013	-.048	-.018	-7.684
40.00	-3818.	15676.	-11492.	418.	284.	599.	-811.	-2397.	-.016	-.078	-.048	-7.208
40.50	-2943.	15678.	-11029.	1650.	277.	606.	-933.	-1518.	-.019	-.059	-.030	-6.571
41.00	2744.	15437.	-10531.	1502.	193.	613.	-1066.	-1309.	-.021	-.064	-.028	-5.966
41.50	-4162.	14932.	-12778.	-2181.	204.	621.	-997.	-2795.	-.020	-.082	-.055	-5.362
42.00	-3780.	14557.	-11244.	-670.	265.	628.	-1105.	-2350.	-.021	-.074	-.046	-4.753
42.50	4239.	13946.	-6542.	603.	270.	636.	-1267.	-2803.	-.024	-.082	-.054	-4.140
43.00	-3251.	[illegible]	-7256.	2448.	219.	643.	-1365.	-1864.	-.026	-.062	-.036	-3.696
43.50	-5225	13550.	-9225.	-1465.	182.	651.	-1398.	-3878.	-.026	-.099	-.073	-3.395
44.00	4505.	13907.	-9403.	-538.	267.	658.	-1621.	-3064.	-.029	-.084	-.057	-3.091
44.50	4276.	13686.	-6955.	1671.	230.	666.	-1680.	-2868.	-.031	-.079	-.053	-2.793
45.00	-6118.	13544.	-8440.	-1767.	223.	674.	-1649.	-4716.	-.030	-.113	-.087	-2.496
45.50	-5273.	13214.	-7369.	-120.	286.	684.	-1662.	-3805.	-.030	-.096	-.069	-2.150
46.00	-5887.	12681.	-4969.	1039.	259.	694.	-1739.	-4443.	-.031	-.106	-.080	-1.803
46.50	-7263.	12725.	-4977.	-646.	250.	703.	-2086.	-5885.	-.037	-.130	-.104	-1.451
47.00	-6768.	12651.	-4303.	93.	275.	713.	-2474.	-5303.	-.044	-.120	-.094	-1.099
47.50	-5893.	12125.	-3375.	1149.	235.	723.	-2665.	-4465.	-.047	-.104	-.079	-.751
48.00	-7347.	11635.	-4608.	-2005.	238.	733.	-2756.	-5912.	-.048	-.128	-.103	-.403
48.50	-4682.	11041.	-4109.	470.	221.	743.	-2742.	-3862.	-.047	-.081	-.066	-.053
49.00	-6172.	10605.	-3964.	-1104.	258.	752.	-2713.	-4671.	-.047	-.105	-.080	.298
49.50	-6657.	10190.	-1394.	-26.	274.	761.	-2698.	-5178.	-.044	-.113	-.088	.649

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 4

S-192 POST FLIGHT FIRST STAGE MOMENTS NOVA 1
ALGOL III SCOUT G-1 34/-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG ,981
FIRST STAGE MOMENT DISTURBANCE - PITCH CHANNEL (CONTINU.))

TIME (SEC)	M(ALPHA) (FT-LB)	M(0) (FT-LB)	M(EFIN) (FT-LB)	M(DAMP) (FT-LB)	CM(PRED)	CM(EFF)	XCP(PRED)P (IN)	XCP(EFF)P (IN)	ET(EFF)P (DEG)	LD(EFF)P (LB/DEG)	LD(PRED) (LB/DEG)
25.00	13054.	1953.	387.	1099.	1.8067	.4706	663.64	530.70	-.381	280.263	34.889
25.50	12740.	1821.	405.	986.	1.5976	.3448	668.71	582.10	-.308	271.966	34.900
26.00	11839.	1675.	424.	766.	1.3702	.7601	673.86	587.21	-.157	110.865	34.972
26.50	8914.	1515.	444.	608.	1.0713	.5074	679.04	571.11	-.141	75.4?7	35.042
27.00	6188.	1342.	464.	1052.	.7497	.4236	684.30	588.37	-.080	50.164	35.113
27.50	7015.	1247.	484.	1218.	.7979	.3543	688.17	566.48	-.117	94.184	35.182
28.00	7853.	1233.	504.	1131.	.8519	.1354	690.70	506.70	-.195	270.747	35.251
28.50	7054.	1215.	524.	1012.	.7535	.2085	693.05	530.11	-.153	438.964	35.320
29.00	6074.	1195.	544.	827.	.6440	.0677	693.14	486.47	-.162	188.894	35.388
29.50	6202.	1171.	565.	934.	.6358	.1378	693.20	518.78	-.141	131.784	35.456
30.00	6308	1191.	575.	928.	.6299	.2488	693.26	553.37	-.111	120.401	35.523
30.50	6952.	1223.	580.	890.	.6686	.3068	693.36	560.84	-.108	104.322	35.590
31.0	7524.	1255.	584.	839.	.7002	.2761	691.67	554.28	-.127	97.498	35.657
31.50	10276.	1287.	588.	1004.	.8887	.3005	689.06	544.82	-.183	107.075	35.724
32.00	11917.	1318.	587.	975.	1.0797	.5492	684.52	582.29	-.170	119.986	35.791
32.50	11882.	1350.	581.	787.	1.0539	1740	679.02	567.31	-.186	108.437	35.856
33.00	12826.	1382.	575.	904.	1.0278	.4938	673.45	570.30	-.173	88.835	35.922
33.50	13189.	1414.	560.	957.	1.0325	.6682	667.79	590.69	-.122	73.558	35.986
34.00	13486.	1446.	566.	838.	1.0283	.6746	660.?2	596.83	-.121	71.824	36.050
34.50	12455.	1478.	568.	880.	.9425	.6227	653.41	592.31	-.108	63.139	36.114
35.00	11502.	1573.	568.	998.	.8658	.6984	645.91	611.91	-.059	51.064	36.177
35.50	10596.	1730.	565.	930.	.7984	.7283	636.68	621.56	-.028	43.083	36.240
36.00	9722.	1802.	585.	857.	.7384	.6823	627.46	610.49	-.029	42.275	36.302
36.50	9064.	2059.	564.	950.	.6920	.6501	618.22	600.42	-.017	40.183	36.383
37.00	8432.	2231.	563.	983.	.6514	.6430	608.99	607.02	-.005	37.260	36.475
37.50	8621.	2408.	562.	922.	.6610	.7409	601.31	619.09	.023	28.145	36.566
38.00	8804.	2591.	560.	761.	.6704	.6798	594.39	596.30	-.001	35.806	36.657
38.50	9113.	2778.	558.	943.	.6869	.6369	587.50	577.47	-.028	40.846	36.747
39.00	9354.	3017.	557.	1050.	.7014	.6758	580.59	575.81	-.018	39.462	36.837
39.50	10069.	3327.	558.	956.	.7461	.6159	573.65	562.25	-.061	51.800	36.925
40.00	10641.	3645.	558.	832.	.7818	.5718	566.70	535.60	-.094	61.398	37.014
40.50	10273.	4059.	553.	792.	.7714	.6127	557.82	535.19	-.078	56.451	37.101
41.00	9861.	4485.	548.	543.	.7594	.6141	549.32	529.40	-.076	55.871	37.188
41.50	8905.	4922.	543.	562.	.7202	.5034	540.82	510.75	-.101	60.643	37.274
42.00	7930.	5371.	537.	718.	.6818	.4880	532.88	505.09	-.096	61.359	37.360
42.50	6922.	5770.	530.	718.	.6408	.4269	523.69	493.29	-.106	78.665	37.444
43.00	6202.	6158.	525.	572.	.6142	.4526	517.12	483.87	-.088	69.130	37.529
43.50	6007.	6556.	521.	467.	.6148	.3591	512.26	478.83	-.125	77.302	37.612
44.00	5755.	6962.	516.	673.	.6131	.3959	507.37	478.34	-.113	71.060	37.695
44.50	5225.	7378.	511.	571.	.5987	.3956	502.51	475.08	-.111	80.600	37.778
45.00	4630.	7803.	506.	544.	.5849	.2085	497.62	458.56	-.143	88.370	37.861
45.50	3897.	8139.	498.	680.	.5597	.3145	492.16	457.26	-.127	87.550	37.942
46.00	3142.	8444.	491.	597.	.5356	.2636	486.68	446.24	-.138	119.788	38.024
46.50	2928.	8752.	485.	561.	.5381	.2027	481.15	437.95	-.167	130.809	38.104
47.00	2512.	9063.	478.	599.	.5278	.2108	475.60	440.07	-.164	145.473	38.184
47.50	1779.	9377.	470.	498.	.5055	.2385	470.12	440.26	-.151	166.692	38.263
48.00	986.	9695.	464.	490.	.4808	.1501	464.62	428.62	-.176	148.288	38.342
48.50	125.	10016.	457.	442.	.4536	.2442	459.10	435.50	-.128	114.746	38.408
49.00	-690.	10341.	451.	503.	.4290	.1564	453.58	421.78	-.152	123.622	38.450
49.50	-1368.	10575.	444.	519.	.4075	.1136	448.05	410.13	-.157	282.829	38.488

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO 5

S-192 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34 -40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST [illegible] MOMENT DISTURBANCE - PITCH CHANNEL

TIME (SEC)	ELTA-M FT-LB	M(AERO) (FT-LB)	M(CONTRL) (FT-LB)	M(I) (FT-LB)	M(JD) (FT-LB)	M(CG) (FT-LB)	M(ETFLX) (FT-LB)	M(PRIME) (FT-LB)	ET(FLX) (DEG)	ET(RIGID) (DEG)	ET(PRIME) (DEG)	(XCG-XCP) (FT)
50.00	-5269.	9781.	-1466.	1571.	218.	771.	-2404.	-3843.	-.041	.089	-.065	1.008
50.50	-8821.	9803.	-3239.	-2925.	246.	780.	-1695.	-7367.	-.028	-.140	-.123	1.398
51.00	-9635.	10350.	-1264.	397.	333.	790.	-1177.	-7091.	-.020	-.143	-.118	1.795
51.50	-8175	11131.	-241.	3182.	225.	800.	-560.	-6735.	-.009	-.135	-.111	1.818
52.00	-10241.	12091.	-4063.	-933.	161.	810.	309.	-8862.	.005	-.168	-.145	1.977
52.50	-10763.	12746.	6099.	-2287.	248.	821.	780.	-9804.	.012	-.175	-.151	2.050
53.00	-10117.	13401.	-4519.	828.	293.	832.	940.	-8600.	.015	-.163	-.138	2.183
53.50	-10906.	13118.	-3249.	774.	236.	844.	731.	-9439.	.012	-.174	-.150	2.151
54.00	-10043.	12889.	-3964.	589.	225.	858.	689.	-8584.	.010	-.158	-.135	2.141
54.50	-9068.	12886.	-5027.	-382.	195.	872.	759.	-7627.	.012	-.141	-.119	2.134
55.00	-9590.	13004.	-7843.	-2405.	260.	886.	878.	-8074.	.014	-.148	-.124	2.127
55.50	-8515.	12905.	-6220.	141.	351.	901.	719.	-6903.	.011	-.131	-.105	2.111
56.00	-8750.	12613.	-4615.	998.	266.	916.	583.	-7816.	.008	-.138	-.109	2.096
56.50	8554.	12495.	-4505.	1199.	240.	931.	581.	-7039.	.009	-.128	-.106	2.083
57.00	-7982.	12303.	-3931.	2081.	150.	946.	594.	-6551.	.009	-.118	-.097	2.072
57.50	-8760.	12362.	-6289.	-718.	144.	963.	882.	-7347.	.013	-.128	-.107	2.047
58.00	-8181.	12438.	-7095.	-601.	176.	979.	1081.	-6708.	.016	-.118	-.097	2.016
58.50	-7817.	12385.	-7131.	402.	203.	996.	1166.	-5708.	.017	-.103	-.081	1.843
59.00	-7896.	12204.	-7259.	-502.	185.	1013.	1251.	-6393.	.018	-.111	-.090	1.715
59.50	-7763.	11920.	-7389.	-818.	287.	1010.	1182.	-6232.	.017	-.110	-.088	1.495
60.00	-7121.	11641.	-5972.	785.	238.	987.	1012.	-5602	.015	-.104	-.082	1.293
60.50	-6576.	11161.	-5475.	1184.	137.	964.	973.	-5191.	.015	-.098	-.078	1.052
61.00	-6217.	10746.	-7589.	-918.	137.	941.	1065.	-4864.	.016	-.095	-.075	.811
61.50	-6555.	10305.	-7533.	-1757.	199.	918.	909.	-5178.	.014	-.103	-.082	.567
62.00	-5462.	9887.	-5188.	1018.	228.	893.	659.	-4084.	.011	-.089	-.066	.383
62.50	-5581.	9467.	-4471.	1110.	150.	861.	683.	-4323.	.012	-.084	-.073	.108
63.00	-5769.	9059.	-6073.	-1041.	124.	824.	793.	-4583.	.014	-.107	-.081	-.092
63.50	-5373.	8692.	-5933.	-843.	169.	786.	717.	-4190.	.013	-.100	-.078	-.295
64.00	-4212.	8308.	-4673.	943.	170.	748.	602.	-3075.	.012	-.082	-.060	-.497
64.50	-4295.	7900.	-4414.	538.	109.	709.	529.	-3267.	.011	-.089	-.067	-.701
65.00	-4512.	7550.	-5123.	-797.	115.	674.	499.	-3523.	.011	-.098	-.076	-.884
65.50	4 67.	7297.	-4777.	-474.	145.	641.	391.	-3188.	.009	-.095	-.073	-1.061
66.00	-3356.	7033.	-3886.	812.	134.	607.	280.	-2431.	.007	-.081	-.059	-1.237
66.50	-3580.	6715.	-3841.	203.	95.	573.	242.	-2736.	.006	-.091	-.070	-1.412
67.00	-3603.	6431.	-4151.	-472.	98.	541.	218.	-2801.	.006	-.097	-.076	-1.570
67.50	-3318.	6057.	-3927.	-346.	108.	511.	222.	-2538.	.006	-.095	-.073	-1.716
68.00	-2847.	5671.	-3413.	210.	104.	481.	214.	-2110.	.007	-.087	-.064	-1.863
68.50	-2556.	5313.	-3080.	408.	85.	450.	197.	-1877.	.006	-.083	-.061	-2.011
69.00	2572.	4965.	-3145.	-65.	73.	425.	190.	-1937.	.007	-.089	-.067	-2.142
69.50	-2437.	4802.	-3128.	-205.	74.	402.	141.	-1892.	.005	-.091	-.069	-2.266
70.00	-2283.	4640.	-2982.	-72.	74.	380.	99.	-1709.	.004	-.088	-.066	-2.389
70.50	-2439.	4432.	-2600.	-293.	73.	356.	87.	-1894.	.004	-.100	-.078	-2.498
71.00	-2180.	4235.	-2470.	62.	70.	333.	74.	-1666.	.003	-.096	-.073	-2.608
71.50	-2006.	3983.	-2230.	188.	63.	309.	70.	-1529.	.003	-.095	-.072	-2.714
72.00	-1863.	3732.	-2096.	178.	53.	285.	67.	-1424.	.003	-.095	-.073	-2.821
72.50	-1662.	3515.	-2135.	91.	47.	265.	62.	-1255.	.003	-.091	-.069	-2.916
73.00	-1548.	3302.	-2208.	-105.	43.	248.	59.	-1167.	.003	-.090	-.068	-3.002
73.50	-1546.	3128.	-2228.	-321.	44.	230.	51.	-1187.	.003	-.097	-.075	-3.090
74.00	-1143.	2352.	-2073.	33.	43.	213.	42.	-808.	.003	-.078	-.055	-3.178
74.50	-1187.	2830.	-1917.	12.	38.	197.	31.	-866.	.002	-.085	-.063	-3.268

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 6
S-192 POST FLIGHT FIRST STAGE MOMENTS NOVA 1
ALGOL III SCOUT G-1 34/-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - PITCH CHANNEL (CONTINUED)

TIME (SEC)	M(ALPHA) (FT-LB)	M(0) (FT-LB)	M(EFIN) (FT-LB)	M(DAMP) (FT-LB)	CM(PRED)	CM(EFF)	XCP(PRED)P (IN)	XCP(EFF)P (IN)	ET(EFF)P (DEG)	LD(EFF)P (LB/DEG)	LD(PRED) (LB/DEG)
50.00	-1905.	10786.	437.	403.	.3808	.1586	442.51	409.27	-.129	237.483	38.546
50.50	-1973.	10914.	428.	435.	.3932	.0053	438.44	361.42	-.176	189.430	38.592
51.00	-1676.	11040.	421.	565.	.4126	.0321	430.36	318.37	-.163	417.021	38.638
51.50	-816.	11167.	414.	366.	.4569	.0061	427.64	197.60	-.144	1981.347	38.684
52.00	140.	11292.	407.	251.	.5056	.0587	425.54	2159.23	-.162	178.410	38.789
52.50	598.	11417.	400.	371.	.5325	.0555	423.36	865.88	-.163	136.694	38.807
53.00	1080.	11503.	393.	419.	.5589	.1097	421.16	659.90	-.148	163.819	38.904
53.50	863.	11545.	386.	323.	.5620	.[illegible]68	419.03	745.19	-.162	226.640	39.001
54.00	633.	11581.	380.	294.	.5444	.0966	416.88	824.30	-.148	180.176	39.097
54.50	652.	11617.	374.	244.	.5479	.1489	414.70	770.97	-.129	123.037	39.192
55.00	671.	11653.	369.	311.	.5514	.1883	412.52	777.17	-.134	107.406	39.286
55.50	556.	11592.	361.	336.	.5495	.1643	410.45	798.34	-.119	115.642	39.380
56.00	446.	11531.	352.	283.	.5477	.1476	408.36	801.50	-.123	144.814	39.473
56.50	488.	11421.	343.	242.	.5507	.1552	406.25	844.26	-.119	145.263	39.651
57.00	528.	11297.	335.	143.	.5530	.1797	404.12	779.87	-.109	152.774	39.828
57.50	732.	11174.	326.	130.	.5631	.1478	401.99	696.41	-.115	117.653	40.006
58.00	921.	11050.	318.	149.	.5727	.1813	399.83	614.62	-.102	104.313	40.183
58.50	986.	10926.	310.	163.	.5765	.2272	398.17	568.74	-.086	96.647	40.361
59.00	957.	10801.	305.	140.	.5758	.1892	398.37	568.13	-.094	101.036	40.538
59.50	777.	10677.	299.	166.	.5676	.1826	398.51	577.84	-.093	97.759	40.017
60.00	624.	10553.	294.	170.	.5606	.2034	398.62	576.71	-.089	102.612	38.798
60.50	523.	10259.	284	96.	.5564	.2170	399.18	558.04	-.084	99.893	37.579
61.00	413.	9965.	275.	92.	.5515	.2211	399.75	546.26	-.079	77.526	36.359
61.50	238.	9671.	266.	131.	.5427	.1837	400.35	588.16	-.089	77.445	35.140
62.00	108.	9377.	256.	145.	.5359	.2273	400.96	597.53	-.078	83.386	33.920
62.50	44.	9083.	247.	93.	.5385	.2068	401.50	566.33	-.083	88.813	32.474
63.00	-43.	8788.	238.	77.	.5274	.1795	402.04	548.27	-.088	71.860	30.888
63.50	-132.	8492.	228.	103.	.5218	.1864	402.62	546.92	-.086	66.565	29.302
64.00	-209.	8195.	219.	103.	.5165	.2441	403.19	523.23	-.070	68.990	27.716
64.50	-275.	7899.	210.	66.	.5116	.2234	403.78	536.38	-.078	62.264	26.131
65.00	-321.	7602.	201.	68.	.5076	.1930	404.38	553.37	-.087	55.808	24.712
65.50	-297.	7311.	193.	86.	.5085	.2064	405.05	583.65	-.066	52.688	23.397
66.00	-250.	7019.	185.	79.	.5111	.2577	405.73	604.80	-.074	49.601	22.081
66.50	246.	6728.	177	56.	.5106	.2886	406.37	652.97	-.085	48.855	20.766
67.00	-232.	6437.	169.	58.	.5109	.2137	407.02	690.88	-.098	44.349	19.555
67.50	-313.	6145.	161.	64.	.5030	.2168	407.65	625.89	-.089	41.197	18.409
68.00	-397.	5854.	153.	62.	.4941	.2363	408.27	568.73	-.088	38.466	17.263
68.50	444.	5562.	145.	50.	.4877	.2441	408.92	547.80	-.077	35.923	16.117
69.00	-486.	5271.	137.	43.	.4812	.2225	409.56	545.65	-.082	33.561	15.160
69.50	-348.	4973.	129.	43.	.4929	.2271	410.24	605.07	-.086	31.288	14.318
70.00	-211.	4688.	121.	42.	.5062	.2480	410.92	781.80	-.084	28.799	13.476
70.50	-207.	4487.	116.	42.	.5056	.2175	411.43	765.11	-.097	29.039	12.635
71.00	-202.	4286.	111.	41.	.5050	.2364	411.94	749.30	-.098	27.468	11.793
71.50	-245.	4085.	106.	37.	.4983	.2380	412.41	679.65	-.091	25.922	10.951
72.00	-285.	3884.	101.	33.	.4911	.2360	412.88	634.13	-.098	23.901	10.109
72.50	-232.	3683.	95.	29.	.4880	.2487	413.39	612.50	-.088	20.782	9.406
73.00	-297.	3482.	90.	27.	.4848	.2493	413.89	601.76	-.087	18.345	8.787
73.50	-266.	3281.	85.	28.	.4871	.2374	414.41	630.08	-.094	17.006	8.168
74.00	-235.	3080.	80.	27.	.4895	.2927	414.98	600.22	-.076	14.079	7.549
74.50	-149.	2879.	75.	25.	.5087	.2876	415.46	782.69	-.[illegible]3	13.702	6.909

ORIGINAL PAGE IS
OF POOR QUALITY

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 7
S-192 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34/-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - PITCH CHANNEL

TIME (SEC)	DELTA-M (FT-LB)	M(AERO) (FT-LB)	M(CONTRL) (FT-LB)	M(I) (FT-LB)	M(JD) (FT-LB)	M(CO) (FT-LB)	M(ETFLX) (FT-LB)	M(PRIME) (FT-LB)	ET(FLX) (DEG)	ET(RIGID) (DEG)	ET(PRIME) (DEG)	(XCG-XCP) (FT)
75.00	-1272.	2703	-1789.	-117.	37.	183.	21.	-982.	.002	-.100	-.077	-3.333
75.50	-1265.	2572.	-1641.	-111.	36.	168.	19.	-994.	.002	-.100	-.085	-3.387
76.00	-1029.	2440.	-1469.	84.	33.	153.	17.	-840.	.002	-.102	-.078	-3.441
76.50	-1265.	2351.	-1355.	-89.	29.	138.	13.	-1037.	.001	-.130	-.106	-3.498
77.00	-1143.	2261.	-1221.	48.	26.	122.	9.	-943.	.001	-.131	-.108	-3.551
77.50	-1141.	2177.	-1118.	60.	23.	111.	6.	-951.	.001	-.143	-.119	-3.597
78.00	-1173.	2091.	-1052.	-6.	21.	102.	4.	-997.	.001	-.159	-.135	-3.638
78.50	-1037.	1969.	-979.	69.	19.	93.	4.	-876.	.001	-.153	-.129	-3.677
79.00	-1052.	1847.	-913.	-12.	17.	84.	3.	-902.	.000	-.171	-.147	-3.717
79.50	-1042.	1745.	-852.	-56.	16.	75.	2.	-907.	.000	-.188	- 164	-3.757
80.00	-905.	1641.	-775.	42.	15.	66.	1.	-784.	.000	-.184	-.159	-3.798
80.50	-813.	1546.	-723.	85.	13.	59.	2.	-702.	.000	-.181	-.157	-3.885
81.00	-661.	1453.	-694.	167.	11.	54.	2.	-558.	.000	-.159	-.134	-3.850
81.50	-573.	1353.	-685.	157.	10.	49.	2.	-478.	.001	-.150	-.125	-3.877
82.00	-616.	1255.	-702.	-7.	9.	44.	3.	-529.	.001	-.177	-.152	-3.904
82.50	-512.	1184.	-701.	21.	8.	40.	3.	-432.	.001	-.163	-.137	-3.933
83.00	-635.	1114.	-700.	-177.	7	35.	2.	-662.	.001	-.226	-.200	-3.962
83.50	-507.	1060.	-674.	-80.	.	31.	2.	-439.	.001	-.197	-.171	-3.980
84.00	-528.	1005.	-640.	-125.	7.	29.	2.	-465.	.001	-.222	-.195	-3.995
84.50	-378.	931.	-597.	-9.	7.	26.	2.	-319.	.001	-.172	-.146	-4.017
85.00	-375.	858.	-549.	-35.	6.	24.	1.	-321.	.001	-.187	-.160	-4.038
85.50	-395.	826.	-505.	-46.	6.	21.	1.	-345.	.001	-.217	-.190	-4.051
86.00	-483.	793.	-446.	-32.	5.	18.	1.	-358.	.001	-.247	-.219	-4.064
86.50	-357.	737.	-367.	5.	4.	17.	1.	-346.	.001	-.256	-.229	-4.080

RUN NO 1 PAGE NO. 8
S 192 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34/-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - PITCH CHANNEL (CONTINUED)

TIME (SEC)	M(ALPHA) (FT-LB)	M(Q) (FT-LB)	M(EFIN) (FT-LB)	M(DAMP) (FT-LB)	CM(PRED)	CM(EFF)	XCP(PRED)P (IN)	XCP(EFF)P (IN)	ET(EFF)P (DEG)	LD(EFF)P (LB/DEG)	LD(PRED) (LB/DEG)
75.00	-68.	2678.	70.	24.	.5165	.2647	415.99	1161.89	-.099	13.761	6.491
75.50	-31.	2562.	67.	24.	.5133	.2517	416.27	1051.96	-.106	13.344	5.983
76.00	-93.	2447.	64.	23.	.5100	.2740	416.56	902.64	-.100	12.060	5.475
76.50	-63.	2331.	61.	21.	.5160	.2205	416.85	1276.82	-.129	12.630	4.967
77.00	33.	2215	56.	20.	.5222	.2472	417.14	1916.41	-.130	11.561	4.459
77.50	4.	2100.	55.	18.	.5310	.2431	417.42	-11754.80	-.142	11.214	4.072
78.00	13.	1954.	52.	17.	.5401	.2260	417.70	-940.69	-.158	11.031	3.760
78.50	35.	1862.	49.	16.	.5400	.2468	417.97	-875.04	-.153	9.856	3.445
79.00	33.	1753.	46.	15.	.5400	.2226	418.24	-995.31	-.170	9.538	3.132
79.50	50.	1637.	43.	14.	.5462	.2091	418.51	-517.11	-.188	8.051	2.819
80.00	65.	1522.	40.	13.	.5526	.2375	418.78	-816.37	-.183	7.803	2.506
80.50	36.	1459.	39.	13.	.5431	.2479	418.96	-811.81	-.181	7.131	2.281
81.00	3.	1396.	37.	11.	.5336	.2827	419.14	-2848.62	-.159	5.972	2.111
81.50	-26.	1332.	36.	10.	.5198	.2020	419.34	1482.40	-.150	5.118	1.941
82.00	-58.	1269.	34.	10.	.5059	.2488	419.56	920.21	-.176	4.876	1.771
82.50	-63.	1206.	32.	9.	.5021	.2772	419.78	800.73	-.162	3.994	1.601
83.00	-68.	1143.	31.	8.	.4983	.2040	420.01	861.14	-.225	4.169	1.431
83.50	-57.	1080.	29.	9.	.5018	.2532	420.13	841.30	-.197	3.420	1.307
84.00	-47.	1017.	27.	8.	.5054	.2302	420.25	966.00	-.221	3.379	1.212
84.50	-57.	953.	26.	9.	.4986	.2887	420.44	742.22	-.172	2.664	1.118
85.00	-64.	830.	24.	8.	.4917	.2884	420.63	702.90	-.186	2.568	1.023

ORIGINAL PAGE IS
OF POOR QUALITY

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 9

S-192 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34--40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - YAW CHANNEL

TIME (SEC)	DELTA-N (FT-LB)	N(AERO) (FT-LB)	N(CONTRL) (FT-LB)	N(I) (FT-LB)	N(JD) (FT-LB)	N(CG) (FT-LB)	N(ETFLX) (FT-LB)	N(PRIME) (FT-LB)	ET(FLX) (DEG)	ET(RIGID) (DEG)	ET(PRIME) (DEG)	ETEFF(T) (DEG)
0.00	248.	-0.	0.	248.	0.	-0.	0.	248.	-.000	0.000	0.000	.000
.50	4202.	-3673.	1996.	2047.	-24.	32.	-482.	4212.	-.009	.079	.079	.102
1.00	-656.	152.	911.	172.	-45.	27.	-216.	-672.	-.005	-.014	-.015	.022
1.50	-696.	424.	146.	-327.	-39.	26.	-197.	-695.	-.005	-.016	-.016	.067
2.00	1057.	897.	-978.	897.	-38.	26.	-135.	1090.	-.003	.026	.026	.086
2.50	185.	1235.	2216.	-904.	-43.	24.	-93.	173.	-.002	.005	.004	.051
3.00	-1001.	1557.	-2167.	-1703.	-15.	24.	-101.	-983.	-.003	-.025	-.024	.028
3.50	-2066.	1760.	-1331.	-1729.	18.	23.	-154.	-2015.	-.004	-.052	-.051	.056
4.00	-2397.	1963.	101.	-498.	39.	23.	-228.	-2323.	-.006	-.061	-.059	.067
4.50	-1845.	2221.	1464.	1587.	32.	23.	-305.	-1781.	-.008	-.047	-.046	.055
5.00	-1787.	2443.	1643.	1987.	-6.	23.	-330.	-1755.	-.008	-.046	-.045	.054
5.50	-2213.	2995.	927.	1345.	-34.	23.	-364.	-2207.	-.009	-.057	-.057	.066
6.00	2037.	3532.	-447.	725.	-52.	23.	-352.	-2047.	-.009	-.063	-.063	.062
6.50	-2636.	4033.	-1837.	-863.	-51.	23.	-324.	-2703.	-.008	-.070	-.070	.082
7.00	-2899.	4455.	-2826.	-1586.	-29.	23.	-309.	-2881.	-.008	-.076	-.075	.084
7.50	[illegible]	5353.	2710.	-1101.	-4.	22.	-384.	-3331.	-.010	-.088	-.087	.101
8.00	-2947.	6297.	-2276.	619.	-0.	22.	-477.	-2894.	-.013	-.077	-.076	.086
8.50	-3541.	6956.	-2363.	561.	-14.	22.	-498.	-3600.	-.013	-.093	-.092	.112
9.00	-4931.	7612.	-2861.	-673.	-15.	22.	-499.	-4888.	-.013	-.130	-.129	.145
9.50	-3786.	7813.	-2808.	727.	-13.	22.	-501.	-3739.	-.013	-.100	-.099	.115
10.00	-2920.	7885.	-3534.	961.	-27.	22.	-465.	-2884.	-.012	-.078	-.077	.080
10.50	-3135.	8043.	-4718.	-248.	-37.	22.	-422.	3106.	-.011	-.084	-.083	.086
11.00	-4335.	8124.	-5144.	-1736.	-6.	22.	-397.	-4268.	-.011	-.115	-.114	.120
11.50	-3757.	8548.	-4212.	147.	4.	22.	-458.	-3676.	-.012	-.100	-.098	.112
12.00	-5639.	8844.	-3875.	-1169.	9.	22.	-490.	-5549.	-.013	-.149	-.147	.168
12.50	[illegible]	[illegible]	-2795.	1125.	18.	22.	-584.	-4929.	-.016	-.133	-.130	.163
13.00	-4681.	[illegible]	-2748.	2037.	-15.	22.	-839.	-4605.	-.017	-.124	-.122	.141
13.50	[illegible]	10394.	-4369.	2706.	-53.	22.	-604.	-2643.	-.016	-.071	-.069	.087
14.00	-1645.	10687.	-7636.	841.	-86.	22.	-501.	-1631.	-.013	-.043	-.043	.068
14.50	611.	10664.	-10770.	-1160.	-88.	22.	-374.	-594.	-.010	-.016	-.016	.047
15.00	-1169.	10671.	12756.	-3562.	-45.	22.	-286.	-1103.	-.007	-.030	-.029	.052
15.50	-143.	11005.	-12285.	-1706.	13.	22.	-318.	-13.	-.008	-.004	-.000	.059
16.00	105.	11143.	-10812.	103.	25.	22.	-384.	258.	-.010	.003	.007	.007
16.50	-1022.	11626.	-9760.	424.	19.	22.	-461.	-873.	-.012	-.026	-.023	.066
17.00	[illegible]	12040.	-9200.	2045.	-3.	22.	-514.	-165.	-.013	-.008	-.004	.034
17.50	-763.	[illegible]	-10228.	1694.	-40.	22.	-569.	-663.	-.015	-.020	-.017	.035
18.00	[illegible]	14653.	-12676.	436.	-61.	22.	-573.	-844.	-.015	-.024	-.022	.042
18.50	2116.	16126.	-14767.	-1367.	-44.	22.	-590.	-2000.	-.015	-.055	-.052	.072
19.00	-926.	17643.	-15097.	390.	-35.	22.	-656.	-756.	-.017	-.023	-.020	.102
19.50	[illegible]	18977.	-17060.	-1595.	-32.	22.	-686.	-2695.	-.018	-.074	-.070	.101
20.00	-3355.	20664	-17170.	-607.	-0.	22.	-787.	-3174.	-.020	-.088	-.083	.163
20.50	1293.	21645.	-16745.	2775.	-26.	22.	-888.	-1128.	-.022	-.034	-.030	.086
21.00	-3926.	22621.	-20232.	-2302.	-50.	22.	-737.	-3777.	-.019	-.104	-.100	.131
21.50	-5106.	24424.	-20428.	-1890.	-1.	22.	-810.	-4899.	-.021	-.135	-.130	.167
22.00	-5620.	26200.	-19057.	620.	20.	22.	-947.	-5382.	-.025	-.140	-.142	.176
22.50	-2159.	28129.	-18625.	6252.	-40.	22.	-1075.	-1978.	-.028	-.057	-.052	.092
23.00	165.	29938.	-26475.	2598.	-161.	22.	-891.	841.	-.023	.004	.006	.190
23.50	-5287.	32828.	-35078.	-8320.	-104.	23.	-701.	-6145.	-.018	-.139	-.135	.242
24.00	-9018.	36268.	-32496.	-6096.	57.	23.	-930.	-8704.	-.024	-.236	-.228	.364
24.50	-6856.	38631.	-27150.	3531.	61.	23.	-1238.	-6828.	-.032	-.179	-.170	.387

ORIGINAL PAGE IS
OF POOR QUALITY

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 10
:-192 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34/-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - YAW CHANNEL (CONTINUED)

TIME (SEC)	N(ALPHA) (FT-LB)	N(O) (FT-LB)	N(EFIN) (FT-LB)	N(DAMP) (FT-LB)	CN(PRED)	CN(EFF)	XCP(PRED)V (IN)	XCP(EFF)V (IN)	ET(EFF)V (DEG)	LD(EFF)V (LB/DEG)	LD(PRED) (LB/DEG)
0.00	-0.	0.	0.	0.	-84.4213********		474.57**********		-.000	5.600	0.000
.50	-3670.	0.	1.	-9.	-60.2071	8.7362	469.87	546.15	.070	197.358	63.442
1.00	176.	0.	3.	-28.	1.4474	-3.9359	543.09	515.84	-.010	14.999	54.513
1.50	448.	0.	4.	-28.	2.4485	-1.3046	553.56	525.25	-.020	-192.729	51.300
2.00	911.	0.	5.	-30.	3.7380	8.2382	578.56	631.68	.023	-9.134	49.388
2.50	1269.	0.	7.	-37.	4.1654	4.7728	591.30	599.68	.002	43.745	47.809
3.00	1562.	0.	8.	-13.	4.2709	1.5343	603.82	558.57	-.027	68.557	46.575
3.50	1753.	0.	10.	17.	4.1094	-.7335	605.36	519.59	-.056	117.665	45.355
4.00	1914.	0.	11.	37.	3.9261	-.9888	606.77	513.16	-.067	-1046.564	44.479
4.50	2177.	0.	13.	31.	3.9689	.6003	610.29	543.34	-.055	-13.476	43.810
5.00	2434.	0.	14.	-5.	3.9937	1.0625	613.82	552.91	-.064	-5.693	43.145
5.50	3015.	0.	17.	-37.	4.1689	1.1096	616.16	553.12	-.066	-63.934	42.486
6.00	3634.	0.	19.	-63.	4.3414	1.9082	618.44	568.60	-.062	843.676	41.830
6.50	4068.	0.	22.	-67.	4.2784	1.4433	621.67	560.32	-.078	106.745	41.180
7.00	4471.	0.	25.	-41.	4.1999	1.4769	624.02	562.10	-.084	85.366	40.533
7.50	5331.	0.	27.	-6.	4.5239	1.6579	625.46	563.67	-.098	94.810	40.251
8.00	6267.	0.	30.	-1.	4.8500	2.5698	626.74	580.01	-.090	96.759	39.970
8.50	6945.	0.	32.	-22.	4.9394	2.4205	632.10	578.40	-.106	105.578	39.695
9.00	7602.	0.	36.	-25.	5.0018	1.7574	637.39	565.29	-.144	115.337	39.423
9.50	7798.	0.	38.	-23.	4.7736	2.4556	639.64	584.31	-.114	98.700	39.152
10.00	7831.	0.	41.	-47.	4.5160	2.8449	641.61	598.51	-.090	75.457	38.881
10.50	8065.	0.	46.	-69.	4.1815	2.5561	643.15	597.06	-.095	68.416	38.717
11.00	8085.	0.	50.	-11.	3.8310	1.7770	644.69	580.00	-.126	76.700	38.618
11.50	8484.	0.	55.	9.	3.7019	2.0625	645.67	591.56	-.112	79.286	38.520
12.00	8725.	0.	59.	20.	3.5278	1.2478	645.26	566.21	-.162	105.685	38.422
12.50	9392.	0.	64.	40.	3.5378	1.6420	644.68	579.15	-.149	122.499	38.323
13.00	10062.	0.	68.	-34.	3.5477	1.8974	644.10	587.24	-.140	118.880	38.272
13.50	10445.	0.	73.	-124.	3.4611	2.5716	643.98	612.46	-.086	67.706	38.248
14.00	10612.	0.	78.	-203.	3.3796	2.8654	644.05	625.29	-.056	48.689	38.225
14.50	10793.	0.	83.	-214.	3.1923	3.0116	644.17	637.15	-.026	40.994	38.201
15.00	10694.	0.	88.	-110.	3.0019	2.6738	644.29	630.67	-.038	42.746	38.178
15.50	10876.	0.	94.	34.	2.8525	2.8151	644.35	642.70	-.012	38.743	38.154
16.00	10974.	0.	101.	67.	2.7007	2.7276	644.41	645.66	-.007	37.608	38.130
16.50	11466.	0.	108.	51.	2.6579	2.4210	644.46	633.19	-.038	43.457	37.964
17.00	11933.	0.	115.	-8.	2.6141	2.5485	644.61	641.32	-.021	39.444	37.712
17.50	13270.	0.	122.	-116.	2.7559	2.5964	644.47	637.09	-.035	41.507	37.460
18.00	14711.	0.	130.	-182.	2.9039	2.7194	644.42	636.28	-.039	41.239	37.209
18.50	16123.	0.	137.	-134.	3.0327	2.6347	644.33	627.48	-.070	44.895	36.959
19.00	17610.	0.	144.	-111.	3.1632	3.0041	644.23	637.72	-.040	39.879	36.710
19.50	18348.	0.	152.	-103.	3.2570	2.7694	644.91	625.31	-.092	45.927	36.461
20.00	20505.	0.	160.	-1.	3.3792	2.8262	646.43	624.64	-.108	47.463	36.189
20.50	21562.	0.	169.	-86.	3.4000	3.1962	648.15	640.02	-.056	40.423	35.903
21.00	22614.	0.	177.	-171.	3.4184	2.8249	649.86	625.89	-.123	47.149	35.618
21.50	24342.	0.	186.	-4.	3.6190	2.7777	651.61	621.92	-.157	50.407	35.334
22.00	25934.	0.	196.	71.	3.6207	2.8362	653.15	628.20	-.174	53.241	35.162
22.50	28068.	0.	205.	-144.	3.7746	3.4842	654.80	643.63	-.086	42.204	35.059
23.00	30315.	0.	214.	-591.	3.9320	3.9534	656.44	657.24	-.019	34.560	34.956
23.50	32991.	0.	224.	-306.	4.1384	3.4701	658.07	634.04	-.167	44.596	34.853
24.00	35619.	0.	234.	216.	4.3380	3.8459	659.69	621.35	-.261	53.001	34.750
24.50	38215.	0.	244.	232.	4.4797	3.6760	661.38	633.67	-.211	51.683	34.756

ORIGINAL PAGE IS
OF POOR QUALITY

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 11
S-192 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34/-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - YAW CHANNEL

TIME (SEC)	DELTA-N (FT-LB)	N(AERO) (FT-LB)	N(CONTRL) (FT-LB)	N(I) (FT-LB)	N(JD) (FT-LB)	N(CG) (FT-LB)	N(ETFLX) (FT-LB)	N(PRIME) (FT-LB)	ET(FLX) (DEG)	ET(RIGID) (DEG)	ET(PRIME) (DEG)	ETEFF(T) (DEG)
25.00	-9352.	41082.	-27056.	3339.	-8.	23.	-1350.	-9081.	-.035	-.242	-.235	.423
25.50	-9271.	41239.	-30377.	404.	-55.	23.	-1156.	-9035.	-.030	-.238	-.232	.408
26.00	-12197.	41431.	-32242.	-3950.	-10.	24.	-1005.	-11904.	-.026	-.310	-.303	.371
26.50	-8709.	[illegible]75.	-30136.	3003.	27.	24.	-1078.	-8365.	-.027	-.220	-.211	.284
27.00	-9719.	[illegible]	-31863.	1108.	-53.	24.	-993.	-9442.	-.025	-.243	-.236	.280
27.50	-14247.	45[illegible]	-34078.	-3856.	-9.	24.	-910.	-13913.	-.023	-.354	-.345	.394
28.00	-12735.	46671.	-31021.	1956.	38.	24.	-1021.	-12340.	-.025	-.314	-.304	.391
28.50	-11934.	46501.	-30862.	2725.	-33.	24.	-971.	-11597.	-.024	-.292	-.283	.361
29.00	-18894.	46060.	-31463.	-5131.	27.	25.	-885.	-18483.	-.021	-.458	-.448	.506
29.50	-16254.	46818.	-25914.	3613.	51.	25.	-1113.	-15805.	-.027	-.391	-.380	.441
30.00	-21849.	47090.	-26593.	-2423.	-5.	25.	-1092.	-21450.	-.026	-.522	-.512	.559
30.50	-21694.	47171.	-23195.	1160.	60.	25.	-1207.	-21226.	-.029	-.514	-.503	.553
31.00	-22587.	46129.	-21211.	3082.	-12.	25.	-1262.	-20188.	-.030	-.484	-.475	.529
31.50	-20771.	44802.	-24136.	-1221.	-37.	26.	-1104.	-20394.	-.026	-.485	-.476	.542
32.00	-18722.	43246.	-23572.	-190.	10.	26.	-1087.	-18299.	-.025	-.433	-.424	.489
32.50	-14590.	40100.	-23022	1507.	-31.	26.	-1015.	-14172.	-.023	-.334	-.326	.403
33.00	-12243.	37117.	-25948.	-1872.	-27.	26.	-797.	-11864.	-.018	-.279	-.270	.344
33.50	-10585.	35820.	-25031.	-601.	-7.	26.	-824.	-10191.	-.019	-.240	-.231	.286
34.00	-10319.	34268.	-24144.	-1003.	14.	27.	-849.	-9905.	-.019	-.232	-.222	.278
34.50	-9502.	33541.	-21759.	1332.	19.	27.	-905.	-9081.	-.022	-.212	-.202	.258
35.00	-9852.	32609.	-21651.	63.	-18.	27.	-1051.	-9468.	-.023	-.218	-.209	.248
35.50	-10605.	32108.	-21387.	-1012.	9.	27.	-1164.	-10196.	-.026	-.233	-.224	.260
36.00	-11189.	31469.	-19285.	-320.	19.	28.	-1361.	-10770.	-.030	-.244	-.235	.275
36.50	-11920.	31720.	-17291.	312.	14.	28.	-1639.	-11506.	-.035	-.258	-.249	.294
37.00	-13154.	31734.	-16901.	-90.	1.	28.	-1857.	-12753.	-.040	-.282	-.273	.321
37.50	-12886.	31272.	-16050.	328.	3.	28.	-2039.	-12484.	-.043	-.273	-.265	.317
38.00	-12881.	30738.	-15493.	172.	-8.	28.	-2212.	-12491.	-.046	-.270	-.262	.317
38.50	-11462.	28807.	-15402.	-355.	-4.	29.	-2231.	-11070.	-.046	-.238	-.230	.286
39.00	-11476.	26899.	-14148.	-996.	9.	29.	-2310.	-11070.	-.048	-.236	-.228	.284
39.50	-8855.	25295.	-12618.	1420.	6.	29.	-2437.	-8452.	-.050	-.181	-.172	.238
40.00	-9542.	23610.	-12603.	-987.	-5.	29.	-2497.	-9150.	-.050	-.193	-.185	.261
40.50	7296.	21149.	-10758.	528.	17.	29.	-2613.	-6885.	-.052	-.146	-.138	.213
41.00	-5167.	18667.	-10182.	654.	-11.	30.	-2681.	-4787.	-.053	-.102	-.095	.173
41.50	-3345.	15425.	-10472.	-930.	-9.	30.	-2556.	-2970.	-.050	-.066	-.058	.154
42.00	-1250.	12674.	-9336.	-351.	20.	30.	-2489.	-846.	-.048	-.024	-.016	.120
42.50	41.	10290.	-7860	41.	25.	31.	-2485.	446.	-.048	.001	.009	.116
43.00	1535.	8453.	-6466.	1086.	6.	31.	-2473.	1918.	-.047	.029	.037	.090
43.50	578.	7766.	-6473.	-698.	-11.	31.	-2589.	942.	-.049	.011	.018	.131
44.00	777.	7173.	-5447.	-200.	25.	31.	-2759.	1174.	-.052	.015	.022	.119
44.50	1247.	6006.	-3900.	607.	9.	32.	-2786.	1626.	-.052	.023	.030	.114
45.00	1545.	4898.	-3351.	364.	-3.	32.	-2761.	1912.	-.051	.029	.035	.145
45.50	1454.	4041.	-3304.	-628.	-1.	32.	-2851.	1814.	-.052	.027	.033	.120
46.00	1761.	3218.	-2628.	-562.	26.	33.	-2973.	2145.	-.054	.032	.039	.140
46.50	1049.	2277.	-107.	118.	32.	33.	-3166.	1434.	-.057	.019	.026	.172
47.00	2871.	1245.	1374.	2213.	1.	33.	-3310.	3220.	-.059	.051	.057	.164
47.50	2482.	7.	161.	-384.	-44.	34.	-3024.	2782.	-.053	.044	.049	.151
48.00	3616.	-900.	-619.	-631.	-9.	34.	-2752.	3947.	-.048	.063	.069	.177
48.50	3494.	-1609.	318.	-502.	41.	34.	-2780.	3871.	-.048	.060	.067	.129
49.00	4015.	-2459.	1937.	690.	4.	35.	-2841.	4351.	-.049	.069	.075	.153
49.50	4021.	-3225.	1401.	-636.	12.	35.	-2881.	4362.	-.049	.068	.074	.150

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 12
S-192 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34 -40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - YAW CHANNEL (CONTINUED)

TIME (SEC)	N(ALPHA) (FT-LB)	N(O) (FT-LB)	N(EFIN) (FT-LB)	N(DAMP) (FT-LB)	CN(PRED)	CN(EFF)	XCP(PRED)Y (IN)	XCP(EFF)Y (IN)	ET(EFF)Y (DEG)	LD(EFF)Y (LB/DEG)	LD(PRED) (LB/DEG)
25.00	40858.	0.	255.	-31.	4.6407	3.5785	663.64	627.55	-.276	58.448	34.829
25.50	41182.	0.	267.	-211.	4.5183	3.5012	668.71	631.91	-.267	56.181	34.900
26.00	41238.	0.	280.	-37.	4.3755	3.0813	673.86	623.77	-.336	61.883	34.972
26.50	42478.	0	293	104.	4.3636	3.4689	679.04	643.11	-.247	56.008	35.042
27.00	43607.	0	306.	-201.	4.3412	3.3736	684.30	643.91	-.268	57.676	35.113
27.50	45080.	0	319.	-35.	4.3534	2.9775	688.17	629.44	-.376	66.530	35.182
28.00	46134.	0	332.	145.	4.3312	3.1371	690.78	638.62	-.339	66.278	35.251
28.50	46260.	0	346.	-124.	4.2167	3.1293	693.05	643.50	-.316	64.737	35.320
29.00	45600.	0.	359	101.	4.0405	2.3663	693.14	613.18	-.480	81.167	35.388
29.50	46255.	0	373	130.	3.9890	2.5872	693.20	625.11	-.418	83.337	35.456
30.00	46737.	6	379.	-20.	3.9249	2.0898	693.26	602.32	-.548	98.468	35.523
30.50	46585.	17	381	219.	3.8032	2.0347	693.36	602.38	-.543	107.406	35.590
31.00	45814.	25	386.	-46.	3.6499	2.0089	691.67	604.29	-.514	110.303	35.657
31.50	44584.	-35	388.	-136.	3.4628	1.8483	689.06	599.34	-.510	101.969	35.724
32.00	42863.	-46	387.	37.	3.2478	1.8278	684.52	602.06	-.459	96.944	35.791
32.50	39885.	-57	384.	-111.	2.9492	1.8718	679.02	611.88	-.358	84.495	35.856
33.00	36541	-6[illegible].	380.	-96.	2.6644	1.7788	673.45	613.99	-.297	72.190	35.922
33.50	35550.	8	375	-24.	2.5077	1.7593	667.79	615.89	.258	68.435	35.986
34.00	33942.	-94	374.	49.	2.3401	1.6266	660.92	609.78	-.251	68.762	36.050
34.50	33208.	-107	375	67.	2.2390	1.5962	653.41	607.21	-.234	69.429	36.114
35.00	32416.	-121	375.	-62.	2.1384	1.4860	645.91	598.89	-.241	70.757	36.177
35.50	31842.	-137.	373.	30.	2.0561	1.3684	636.68	587.98	-.258	73.593	36.240
36.00	31183	153.	373	62.	1.9721	1.2611	627.46	578.04	-.273	79.802	36.302
36.50	31474.	-173	372.	47.	1.9496	1.2073	618.22	569.24	-.293	88.097	36.383
37.00	31611.	-191	372.	2.	1.9183	1.1158	608.99	558.50	-.321	94.729	36.475
37.50	31191	-301	371	10.	1.8511	1.0789	601.31	553.84	-.316	96.486	36.566
38.00	30824	466	370	-26.	1.7874	1.0299	594.39	548.79	-.317	98.513	36.657
38.50	29074.	-626	369.	-13.	1.6426	.9808	587.50	546.67	-.285	91.579	36.747
39.00	27301.	-797	368	28.	1.5026	.8520	580.59	539.44	-.284	96.685	36.837
39.50	25884.	-974.	368.	18.	1.3873	.8941	573.65	542.11	-.230	88.447	36.925
40.00	24433.	-1157.	368.	-13.	1.2738	.7516	566.70	532.92	-.243	92.291	37.014
40.50	22137.	-1401	365.	48.	1.1159	.7233	557.82	531.83	-.198	86.198	37.101
41.00	19953.	-1651.	362.	-32.	.9707	.6971	549.32	530.81	-.156	73.770	37.188
41.50	17004.	1812	358	25.	.7861	.6117	540.82	528.15	-.116	60.220	37.274
42.00	14011.	1944.	354	53.	.6288	.5647	532.28	527.27	-.073	46.917	37.360
42.50	11840.	-1967.	350.	68.	.4982	.5002	523.69	523.86	-.047	37.078	37.444
43.00	10032.	-1991.	346	15.	.4021	.4784	517.12	523.88	-.018	20.777	37.529
43.50	9464	-2014	344	-28.	.3646	.3929	512.26	514.74	-.038	31.357	37.612
44.00	8806	-2037.	341	63.	.3263	.3638	507.37	510.64	-.037	27.766	37.695
44.50	7734	-2051.	338	23.	.2681	.3274	502.51	507.33	-.029	15.497	37.778
45.00	6653.	-2052	334	-7.	.2140	.2865	497.62	504.60	-.022	5.655	37.861
45.50	5801	-2055	329	3.	.1728	.2404	492.16	498.63	-.025	7.423	37.942
46.00	4923	-2050	324.	61.	.1309	.2122	486.68	494.42	-.028	-8.202	38.024
46.50	3951	-2077.	320.	71.	.0866	.1347	481.15	485.74	-.038	-634.999	38.104
47.00	3027.	-2099.	315	2.	.0423	.1732	475.60	488.11	-.008	180.743	38.184
47.50	1833.	-2103.	310.	-33.	-.0095	.1029	470.12	481.94	-.010	1083.057	38.263
48.00	920.	-2107.	306.	-13.	-.0534	.1093	464.62	483.61	.015	-355.308	38.342
48.50	117.	-2111	302.	82.	-.0892	.0671	459.10	477.91	.012	775.620	38.402
49.00	-649.	-2114.	297.	7.	-.1228	.0556	453.58	475.72	.020	152.570	38.450
49.50	-1423.	-2118	293.	23.	-.1564	.0212	448.05	470.07	.019	196.945	38.498

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 13
S-192 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34/-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - YAW CHANNEL

TIME (SEC)	DELTA-N (FT-LB)	M(AERO) (FT-LB)	M(CONTRL) (FT-LB)	M(I) (FT-LB)	M(JD) (FT-LB)	M(CG) (FT-LB)	M(ETFLX) (FT-LB)	M(PRIME) (FT-LB)	ET(FLX) (DEG)	ET(RIGID) (DEG)	ET(PRIME) (DEG)	ETEFF(T) (DEG)
50.00	5485.	-4114.	1639.	46.	-38.	35.	-2961.	5771.	-.050	.093	.097	.136
50.50	3807.	-4650.	734.	-2808.	41.	36.	-2775.	4165.	-.046	.064	.070	.177
51.00	6082.	-5228.	5372.	5439.	47.	36.	-2871.	844.	-.048	.134	.140	.185
51.50	3228.	-5291.	1695.	-2842.	-66.	36.	-2445.	3471.	-.040	.053	.057	.145
52.00	4330.	-4861.	2683.	-19.	54.	37.	-2262.	4690.	-.037	.071	.077	.166
52.50	4710.	-5245.	5964.	2699.	-27.	37.	-2540.	4983.	-.041	.076	.081	.167
53.00	4348.	-5547.	3709.	-32.	-53.	37.	-2526.	4591.	-.041	.070	.074	.160
53.50	4588.	-5399.	2744.	-442.	-23.	39.	-2391.	4859.	-.038	.073	.077	.166
54.00	5131.	-5235.	2615.	225.	-24.	40.	-2302.	5399.	-.036	.081	.085	.155
54.50	4748.	-5250.	2435.	-366.	23.	42.	-2363.	5059.	-.037	.074	.079	.135
55.00	4325.	-5351.	3995.	584.	7.	44.	-2516.	4620.	-.039	.067	.071	.137
55.50	3612.	-4946.	4626.	1031.	-17.	45.	-2289.	3878.	-.035	.055	.059	.120
56.00	2766.	-4541.	2797.	-888.	-26.	47.	-1932.	3019.	-.029	.042	.046	.124
56.50	2507.	-4172.	3417.	35.	-20.	49.	-1746.	2763.	-.026	.037	.041	.119
57.00	2064.	-3807.	2742.	-448.	-5.	51.	-1493.	2331.	-.022	.030	.034	.109
57.50	1046.	-3702.	2945.	-450.	-32.	53.	-1161.	1283.	-.017	.015	.019	.115
58.00	1407.	-2771.	1708.	-357.	-1.	55.	-756.	1671.	-.011	.020	.024	.103
58.50	767.	-2545.	2795.	387.	-1.	57.	-687.	1028.	-.010	.011	.015	.086
59.00	818.	-2323.	1293.	-661.	-34.	59.	-474.	1044.	-.007	.012	.015	.094
59.50	1474.	-2208.	968.	-139.	17.	60.	-450.	1749.	-.006	.021	.025	.095
60.00	1203.	-2151.	1489.	133.	-4.	60.	-464.	1452.	-.007	.017	.021	.090
60.50	982.	-2011.	1742.	336.	-27.	60.	-409.	1202.	-.006	.015	.018	.084
61.00	934.	-1868.	1054.	-147.	-15.	59.	-311.	1160.	-.005	.014	.018	.080
61.50	809.	-1724.	781.	-272.	-17.	59.	-180.	1026.	-.003	.013	.016	.090
62.00	998.	-1623.	1528.	830.	-19.	58.	-112.	1206.	-.002	.016	.020	.079
62.50	501.	-1567.	442.	-583.	-31.	57.	16.	689.	.000	.008	.012	.083
63.00	460	-1506.	468.	-438.	6.	55.	78.	678.	.001	.008	.012	.088
63.50	636.	-1493.	913.	245.	8.	53.	129.	847.	.002	.012	.016	.088
64.00	-65	-1512.	1516.	149.	-1.	51.	162.	129.	.003	-.001	.003	.070
64.50	171.	-1497.	1607.	442.	-12.	49.	124.	345.	.003	.004	.007	.078
65.00	-206.	-1464.	1064.	-463.	-18.	47.	114.	-45.	.002	-.004	-.001	.087
65.50	102.	-1440.	1234.	57.	7.	45.	110.	281.	.003	.002	.006	.086
66.00	340	-1442.	1223.	262.	-12.	43.	110.	493.	.003	.008	.012	.075
66.50	231.	-1458.	550.	-123.	-15.	41.	128.	374.	.003	.006	.010	.086
67.00	344	-1466.	661.	-235.	-4.	39.	142.	540.	.004	.011	.015	.093
67.50	75.	-1463	543.	-272.	2.	37.	132.	220.	.004	.002	.006	.089
68.00	619	-1462.	1147.	461.	-1.	35.	123.	754.	.004	.019	.023	.083
68.50	405	-1448.	1027.	127.	-9.	33.	116.	528.	.004	.013	.017	.079
69.00	300	-1423.	837.	-155.	-11.	31.	111.	411.	.004	.010	.014	.083
69.50	435.	-1378	780.	-39.	-7.	29.	101.	543.	.004	.016	.020	.088
70.00	300.	-1332	847.	-72.	-5.	28.	88.	403.	.003	.012	.016	.086
70.50	-46.	-1247	820.	-376.	-1.	26.	71.	56.	.003	-.002	.002	.097
71.00	95.	-1163.	335.	-55.	-0.	25.	53.	192.	.002	.004	.008	.093
71.50	240.	-1178.	1011.	149.	0.	23.	53.	333.	.002	.011	.016	.092
72.00	222	-1193.	982.	80.	-5.	21.	53.	305.	.003	.011	.016	.093
72.50	421.	-1117	813.	173.	-9.	20.	45.	495.	.002	.023	.027	.091
73.00	298.	-1036.	532.	-158.	-9.	19.	39.	367.	.002	.017	.021	.089
73.50	-158.	-933.	413.	632.	-2.	17.	30.	-86.	.002	-.010	-.005	.094
74.00	190.	-833.	663	61.	5.	16.	19.	265.	.001	.013	.018	.076
74.50	-142.	-723.	820.	-18.	2.	15.	10.	-75.	.001	-.010	-.005	.084

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 14

S-192 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34/-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - YAW CHANNEL (CONTINUED)

TIME (SEC)	M(ALPHA) (FT-LB)	M(O) (FT-LB)	M(EFIN) (FT-LB)	M(DAMP) (FT-LB)	CN(PRED)	CN(EFF)	XCP(PRED)Y (IN)	XCP(EFF)Y (IN)	ET(EFF)Y (DEG)	LD(EFF)Y (LB/DEG)	LD(PRED) (LB/DEG)
50.00	-2211.	-2121.	288.	-70.	-.1802	.0506	442.51	478.33	.043	283.797	38.546
50.50	-2899.	-2106.	282.	72	-.2201	-.0527	436.44	458.47	.017	325.841	38.592
51.00	-3495.	-2090.	278.	86	-.2461	.1100	430.36	480.16	.087	121.879	38.638
51.50	-3358.	-2099.	273.	-107.	-.2409	-.0084	427.84	449.69	.013	144.179	38.684
52.00	-3102.	-2112.	269.	84.	-.2306	-.0391	425.54	458.67	.034	128.174	38.729
52.50	-3343.	-2125.	264.	-41.	-.2423	-.0336	423.36	458.01	.035	88.607	38.807
53.00	-3592.	-2139.	259.	-76.	-.2544	-.0614	421.16	452.00	.029	104.003	38.994
53.50	-3471.	-2152.	255.	-31.	-.2501	-.0460	419.03	453.14	.035	131.965	39.001
54.00	-3290.	-2165.	251.	-31.	-.2431	-.0144	416.88	456.94	.045	148.327	39.097
54.50	-3347.	-2178.	247.	28.	-.2468	-.0347	414.70	451.02	.037	147.827	39.192
55.00	-3412.	-2191.	244.	8.	-.2507	-.0578	412.52	444.87	.028	99.686	39.286
55.50	-2978.	-2187.	238.	-19.	-.2336	-.0702	410.45	441.17	.020	82.867	39.380
56.00	-2563.	-2182.	232.	-28.	-.2170	-.0905	408.36	435.50	.013	94.461	39.473
56.50	-2216.	-2163.	227.	-20.	-.2025	-.0865	406.25	434.54	.011	80.465	39.651
57.00	-1884.	-2138.	221.	-5.	-.1881	-.0916	404.12	431.36	.008	81.693	39.828
57.50	-1374.	-2114.	215.	-29.	-.1650	-.1155	401.99	420.70	-.002	59.764	40.006
58.00	-889.	-2090.	210.	-1.	-.1425	-.0752	399.83	438.11	.009	86.019	40.183
58.50	-683.	-2066.	205.	-0.	-.1331	-.0960	398.17	424.33	.001	55.622	40.361
59.00	-456.	-2042.	201.	-26.	-.1223	-.0823	398.37	435.25	.005	75.715	40.538
59.50	-400.	-2018.	197.	12.	-.1198	-.0468	398.51	464.63	.015	123.639	40.017
60.00	-348.	-1994.	194.	-3.	-.1174	-.0571	398.62	452.29	.011	88.018	38.798
60.50	-242.	-1938.	188.	-10.	-.1125	-.0618	399.18	450.34	.009	66.825	37.579
61.00	-157.	-1882.	181.	-10.	-.1083	-.0587	399.75	457.64	.010	80.908	36.359
61.50	-62.	-1826.	175.	-11.	-.1034	-.0591	400.35	488.63	.010	85.493	35.140
62.00	-10.	-1770.	169.	-12.	-.1006	-.0442	400.96	781.16	.014	64.609	33.920
62.50	3.	-1714.	163.	-20.	-.0998	-.0706	401.50	203.86	.009	83.669	32.474
63.00	-8.	-1658.	157.	4.	-.1005	-.0727	402.04	339.33	.010	73.273	30.888
63.50	46.	-1602.	151.	5.	-.1023	-.0632	402.62	354.15	.014	57.956	29.302
64.00	110.	-1546.	145.	-1.	-.1071	-.1113	403.19	406.72	.002	26.035	27.716
64.50	-137.	-1490.	139.	-7.	-.1092	-.0978	403.78	393.33	.006	30.073	26.131
65.00	-152.	-1434.	133.	-11.	-.1106	-.1249	404.38	418.76	-.008	17.884	24.712
65.50	-191.	-1379.	127.	4.	-.1139	-.1065	406.05	398.28	.005	26.170	23.397
66.00	-232.	-1324.	122.	-7.	-.1176	-.0919	405.73	384.00	.011	30.943	22.081
66.50	-297.	-1269	117.	-9.	-.1234	-.1051	406.37	393.16	.009	28.105	20.766
67.00	-361.	-1214.	111.	-3.	-.1297	-.0972	407.02	386.43	.014	36.571	19.555
67.50	410.	-1159.	106.	1.	-.1353	-.1280	407.65	403.89	.006	20.546	18.409
68.00	-455.	-1104.	101.	-1.	-.1414	-.0854	408.27	378.02	.023	30.980	17.263
68.50	-468.	-1049.	95.	-6.	-.1465	-.1076	408.92	388.70	.017	25.626	16.117
69.00	-512.	-994.	90.	-6.	-.1515	-.1213	409.56	394.47	.014	23.241	15.160
69.50	-520.	-939.	85.	-4.	-.1553	-.1090	410.24	387.47	.020	26.174	14.318
70.00	-524.	-884.	80.	-3.	-.1592	-.1253	410.92	394.46	.016	20.570	13.476
70.50	476.	-847.	76.	-0.	-.1583	-.1617	411.43	414.31	.001	11.580	12.635
71.00	-427.	-809.	73.	-0.	-.1528	-.1411	411.94	404.99	.006	13.594	11.793
71.50	-477.	-771.	70.	0.	-.1619	-.1307	412.41	396.00	.014	14.908	10.951
72.00	-524.	-733.	66.	-3.	-.1715	-.1413	412.88	398.57	.014	13.614	10.109
72.50	-479.	-695.	63.	-5.	-.1690	-.1085	413.39	382.69	.025	16.927	9.406
73.00	-433.	-657.	60.	-6.	-.1859	-.1206	413.89	389.09	.020	16.433	8.787
73.50	-369.	-619.	56.	-1.	-.1597	-.1862	414.41	430.25	-.008	3.307	8.168
74.00	-308.	-581.	53.	3.	-.1529	-.1202	414.98	391.31	.014	10.952	7.549
74.50	-231.	-543.	49.	2.	-.1428	-.1686	416.46	439.43	-.010	5.096	6.999

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 15
S-192 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34/-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - YAW CHANNEL

TIME (SEC)	DELTA-N (FT-LB)	N(AERO) (FT-LB)	N(CONTRL) (FT-LB)	N(I) (FT-LB)	N(JD) (FT-LB)	N(CG) (FT-LB)	N(ETFLX) (FT-LB)	N(PRIME) (FT-LB)	ET(FLX) (DEG)	ET(RIGID) (DEG)	ET(PRIME) (DEG)	ETEFF(T) (DEG)
75.00	-97.	-617.	900.	206.	3.	14.	3.	-34.	.000	-.008	-.003	.099
75.50	-247.	-633.	913.	51.	1.	13.	6.	-190.	.000	-.021	-.016	.108
76.00	-412.	-645.	934.	-105.	0.	12.	6.	-357.	.001	-.038	-.033	.107
76.50	-75.	-652.	938.	228.	1.	10.	6.	-24.	.001	-.008	-.002	.120
77.00	-61.	-660.	880.	174.	-3.	9.	7.	-16.	.001	-.007	-.002	.130
77.50	-65.	-664.	740.	25.	-2.	8.	8.	-23.	.001	-.008	-.003	.142
78.00	371.	-666.	651.	369.	-4.	8.	9.	409.	.001	.060	.055	.166
78.50	441.	-696.	476.	233.	-6.	7.	10.	475.	.002	.065	.070	.167
79.00	378.	-713.	269.	-59.	-6.	6.	12.	409.	.002	.061	.066	.182
79.50	470.	-719.	135.	-141.	-4.	6.	11.	460.	.002	.078	.083	.204
80.00	412.	-713.	74.	-213.	-2.	5.	11.	441.	.002	.084	.090	.203
80.50	349.	-685.	61.	-263.	-1.	5.	9.	378.	.002	.078	.084	.198
81.00	395.	-657.	100.	-150.	0.	4.	8.	424.	.002	.095	.102	.186
81.50	229	-585.	154.	-191.	1.	4.	6.	258.	.002	.060	.068	.162
82.00	282.	-516.	230.	5.	1.	3.	4.	309.	.001	.081	.089	.195
82.50	197.	-415.	276.	64.	1.	3.	3.	222.	.001	.063	.071	.174
83.00	56.	-320.	293.	34.	1.	3.	1.	80.	.000	.020	.028	.226
83.50	136.	-370.	320.	51.	1.	2.	2.	158.	.001	.053	.062	.204
84.00	238.	-412.	327.	157.	0.	2.	2.	258.	.001	.100	.109	.243
84.50	217.	-368.	312.	165.	-0.	2.	2.	235.	.001	.099	.107	.190
85.00	253.	-326.	272.	202.	-1.	2.	1.	270.	.001	.126	.135	.225
85.50	259.	-318.	218.	161.	-1.	2.	1.	275.	.001	.143	.151	.260
86.00	219.	-309.	170.	82.	-1.	1.	1.	234.	.001	.134	.143	.281
86.50	116	-241.	140.	16.	-1.	1.	1.	130.	.000	.077	.086	.267

RUN NO. 1 PAGE NO. 16
S-192 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34/-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - YAW CHANNEL (CONTINUED)

TIME (SEC)	N(ALPHA) (FT-LB)	N(O) (FT-LB)	N(EF N) (FT-LB)	N(DAMP) (FT-LB)	CN(PRED)	CN(EFF)	XCP(PRED)V (IN)	XCP(EFF)V (IN)	ET(EFF)V (DEG)	LD(EFF)V (LB/DEG)	LD(PRED) (LB/DEG)
75.00	-159.	-505.	46.	2.	-.1315	-.1507	415.99	440.40	-.007	5.388	6.491
75.50	-194.	-483.	44	0.	-.1401	-.1912	416.27	468.15	-.021	3.396	5.983
76.00	-226.	-462.	42.	0.	-.1489	-.2380	416.56	491.87	-.038	1.561	5.475
76.50	-253.	-44[illegible]	40.	1.	-.1576	-.1747	416.85	428.30	-.007	4.308	4.967
77.00	-278.	[illegible]	38.	-2.	-.1665	-.1811	417.14	426.47	-.006	3.937	4.459
77.50	-302.	-39[illegible]	36.	-2.	-.1763	-.1927	417.42	426.69	-.007	3.458	4.072
78.00	-323.	-374.	34.	-3.	-.1862	-.0872	417.70	367.56	.051	7.470	3.758
78.50	-372.	-353.	33.	-5.	-.2054	-.0803	417.97	365.57	.067	9.056	3.445
79.00	-413.	-331.	31.	-5.	-.2249	-.1106	418.24	377.42	.063	10.961	3.132
79.50	-434.	-309.	29.	-4.	-.2406	-.1014	418.51	373.87	.080	19.113	2.819
80.00	-450.	-287.	27.	-2.	-.2666	-.1133	418.78	377.07	.086	28.225	2.506
80.50	-435.	-275.	26.	-1.	-.2679	-.1311	418.96	382.11	.080	26.898	2.281
81.00	-413.	-263.	25.	0.	-.2590	-.1001	419.14	375.58	.087	18.118	2.111
81.50	-358.	-251.	23.	1.	-.2424	-.1512	419.34	380.54	.068	7.593	1.941
82.00	-301.	-239.	22.	1.	-.2256	-.1089	419.56	375.67	.082	6.100	1.771
82.50	-210.	-228.	21.	1.	-.1921	-.1057	419.78	375.49	.063	3.940	1.601
83.00	-125.	-216.	20.	1.	-.1581	-.1321	420.01	398.77	.020	2.008	1.431
83.50	-186.	-204.	19.	1.	-.1912	-.1244	420.13	385.17	.064	2.501	1.307
84.00	-233.	-192.	18.	0.	-.2245	-.1005	420.25	372.52	.101	3.122	1.212
84.50	-204.	-180.	17.	-0.	-.2137	-.0931	420.44	369.34	.100	2.815	1.118
85.00	-172.	-168.	16.	-1.	-.2027	-.0520	420.63	349.52	.127	3.126	1.023

ORIGINAL PAGE IS
OF POOR QUALITY

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 17
S-192 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34/-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981

NOTE... THE FOLLOWING EFFECTIVE OR DELTA PARAMETERS ARE CALCULATED ASSUMING
THE DELTA (RESIDUAL) MOMENTS ARE DUE TO WINDS

TIME (SEC)	ALTITUDE (KILOFEET)	WIND VELOCITY (FT/SEC)	EFFECTIVE WIND VEL (FT/SEC)	DELTA WIND VEL (FT/SEC)	WIND DIRECTION (DEG)	EFFECTIVE WIND DIR (DEG)	DELTA ALPHA (DEG)	DELTA BETA (DEG)
0.00	0.00	19.00	**********	**********	325.00	260.13	**********	**********
.50	.10	19.00	92.86	-73.86	325.00	306.31	86.17	-78.83
1.00	.20	19.00	348.51	-329.51	325.00	6.75	239.19	243.82
1.50	.30	19.00	176.06	-157.06	325.00	144.91	-156.75	-46.84
2.00	.40	20.00	46.76	-26.76	324.70	[illegible]	-32.48	13.57
2.50	.50	21.49	20.13	1.35	324.46	10.01	-10.16	1.33
3.00	.60	23.11	13.47	9.64	324.14	311.65	-.41	-4.73
3.50	.70	24.73	5.88	18.85	323.82	7.81	-2.23	-8.00
4.00	.80	26.35	13.21	13.15	323.50	25.46	-2.44	-7.94
4.50	.90	27.98	20.44	7.64	323.18	350.05	-1.49	-5.19
5.00	1.00	29.62	24.11	5.51	322.86	351.78	-.40	-4.19
5.50	1.10	31.26	23.43	7.84	322.54	360.02	.06	-4.80
6.00	1.20	32.90	26.51	6.39	322.22	343.39	-.15	-3.21
6.50	1.30	34.54	33.31	1.23	321.90	340.85	-1.00	-3.58
7.00	1.40	36.18	30.78	5.40	321.58	346.60	-.64	-3.38
7.50	1.50	37.07	28.07	9.00	321.53	344.96	.10	-3.41
8.00	1.60	37.20	27.67	9.54	321.74	338.15	.48	-2.86
8.50	1.70	37.34	26.03	11.30	321.95	339.25	.73	-2.75
9.00	1.80	37.47	26.92	10.55	322.16	349.02	.30	-3.34
9.50	1.90	37.61	28.79	8.81	322.38	339.59	.30	-2.32
10.00	2.00	37.74	31.86	5.88	322.60	326.19	.05	-1.02
10.50	2.20	38.02	34.90	3.12	323.02	338.02	-.43	-1.56
11.00	2.40	38.45	34.92	3.53	323.56	343.17	-.58	-1.93
11.50	2.60	38.88	34.80	4.08	324.10	330.00	-.25	-1.52
12.00	2.80	39.31	28.49	10.82	324.64	343.36	.51	-2.11
12.50	3.00	39.74	30.63	9.11	325.18	340.87	.37	-1.75
13.00	3.20	40.50	34.65	5.86	325.61	341.06	-.01	-1.58
13.50	3.40	41.75	40.08	1.67	326.00	326.18	-.27	-.81
14.00	3.60	43.00	40.49	2.51	326.16	330.17	.04	-.47
14.50	3.80	44.25	41.09	3.16	326.41	325.50	.33	-.16
15.00	4.00	45.50	41.92	3.58	[illegible]	327.45	.27	-.20
15.50	4.30	47.05	43.55	3.49	[illegible]	[illegible]	.43	-.03
16.00	4.60	47.27	48.30	-1.03	[illegible]	[illegible]	-.11	.03
16.50	4.90	47.50	49.67	-2.17	[illegible]	[illegible]	-.30	-.21
17.00	5.20	47.73	49.36	-1.63	[illegible]	[illegible]	-.23	-.06
17.50	5.50	47.95	47.66	.30	[illegible]	[illegible]	-.06	-.14
18.00	5.80	49.26	49.31	-.05	[illegible]	[illegible]	-.18	-.16
18.50	6.10	50.84	49.93	.91	[illegible]	[illegible]	-.14	-.34
19.00	6.40	52.42	46.81	5.61	324.07	321.40	.40	-.13
19.50	6.70	54.00	42.90	11.10	[illegible]	[illegible]	.83	-.40
20.00	7.00	55.58	46.84	8.74	[illegible]	[illegible]	[illegible]	-.45
20.50	7.40	57.68	53.98	3.70	[illegible]	[illegible]	[illegible]	-.16
21.00	7.80	59.78	54.44	5.34	[illegible]	[illegible]	.16	-.46
21.50	8.20	61.88	55.06	6.82	[illegible]	[illegible]	.01	-.56
22.00	8.60	64.00	58.63	5.37	324.97	[illegible]	[illegible]	-.50
22.50	9.00	65.22	62.29	2.93	323.00	[illegible]	[illegible]	-.21
23.00	9.40	65.64	59.29	6.25	319.34	[illegible]	[illegible]	.02

ORIGINAL PAGE IS
OF POOR QUALITY

Figure 6 (continued)
Sample Problem Output

RUN NO. 1
S-192 POST FLIGHT FIRST STAGE MOMENTS NOVA I PAGE NO. 18
ALGOL III SCOUT G-1 34/-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981

NOTE... THE FOLLOWING EFFECTIVE OR DELTA PARAMETERS ARE CALCULATED ASSUMING
THE DELTA (RESIDUAL) MOMENTS ARE DUE TO WINDS

TIME (SEC)	ALTITUDE (KILOFEET)	WIND VELOCITY (FT/SEC)	EFFECTIVE WIND VEL (FT/SEC)	DELTA WIND VEL (FT/SEC)	WIND DIRECTION (DEG)	EFFECTIVE WIND DIR (DEG)	DELTA ALPHA (DEG)	DELTA BETA (DEG)
25.00	11.00	66.40	49.92	16.48	306.51	290.56	.08	-.08
25.50	11.40	65.63	50.31	15.31	305.56	298.07	.77	-.08
26.00	11.80	64.86	50.81	14.04	304.61	305.36	.36	-.77
26.50	12.20	64.08	53.74	10.34	303.66	302.54	.32	-.61
27.00	12.60	63.31	53.78	9.53	302.70	304.13	.19	-.53
27.50	13.00	62.37	49.02	13.35	302.70	306.11	.24	-.73
28.00	13.40	61.31	47.94	13.37	303.34	301.92	.37	-.62
28.50	13.80	60.25	48.59	11.66	303.97	304.01	.28	-.56
29.00	14.20	59.19	42.50	16.69	304.60	308.24	.29	-.86
29.50	14.60	58.14	43.84	14.30	305.24	308.23	.25	-.71
30.00	15.00	57.08	40.04	17.04	305.87	314.33	.19	-.93
30.50	15.50	56.81	40.16	16.65	306.89	315.75	.18	-.90
31.00	16.00	56.60	40.05	16.56	307.93	315.53	.22	-.85
31.50	16.50	56.40	38.01	18.39	308.97	314.74	.31	-.85
32.00	17.00	56.20	39.21	16.98	310.00	315.55	.29	-.77
32.50	17.50	56.02	40.75	15.27	311.02	312.77	.32	-.60
33.00	18.00	56.59	42.73	13.86	311.48	312.12	.31	-.52
33.50	18.50	57.15	45.64	11.51	311.95	313.08	.22	-.46
34.00	19.00	57.71	45.92	11.79	312.41	314.45	.22	-.45
34.50	19.50	58.28	46.86	11.42	312.87	314.90	.21	-.43
35.00	20.00	58.84	48.59	10.25	313.34	318.46	.12	-.46
35.50	20.60	60.46	50.37	10.09	313.42	321.22	.05	-.52
36.00	21.20	62.36	50.88	11.47	313.36	322.05	.06	-.58
36.50	21.80	64.26	51.90	12.36	313.30	323.97	.04	-.66
37.00	22.40	66.16	52.51	13.65	313.24	326.83	.01	-.77
37.50	23.00	68.03	56.13	11.91	313.21	328.94	-.08	-.80
38.00	23.60	69.01	54.59	14.42	313.08	329.43	-.01	-.83
38.50	24.20	69.99	54.35	15.64	314.76	327.82	.06	-.78
39.00	24.80	70.96	55.36	15.61	315.53	330.47	.03	-.83
39.50	25.40	71.94	54.38	17.57	316.30	324.86	.18	-.68
40.00	26.00	72.92	49.41	23.50	317.08	325.02	.31	-.78
40.50	26.70	74.15	53.96	20.21	319.22	326.30	.27	-.66
41.00	27.40	75.40	57.16	18.24	321.46	325.74	.28	-.53
41.50	28.10	76.64	54.50	22.13	323.69	320.21	.48	-.30
42.00	28.80	77.88	58.84	19.06	325.83	317.59	.51	-.17
42.50	29.50	78.30	58.40	20.90	328.03	311.40	.08	.01
43.00	30.20	82.26	60.42	12.84	328.83	309.97	.61	.29
43.50	30.90	85.23	55.40	29.83	329.63	286.02	1.11	.12
44.00	31.60	88.19	58.90	29.30	330.43	286.03	1.11	.19
44.50	32.30	91.16	63.30	27.88	331.27	281.04	1.24	.36
45.00	33.00	94.17	71.39	22.78	332.04	263.10	2.16	.66
45.50	33.80	98.69	84.20	14.48	333.17	243.61	2.53	.70
46.00	34.60	103.20	172.45	-69.25	334.30	216.84	4.39	1.31
46.50	35.40	107.72	607.[illegible]	-599.57	335.43	192.30	12.27	1.77
47.00	36.20	112.23	1531.[illegible]	-1419.40	336.56	27.31	-43.65	-18.48
47.50	37.00	116.15	423.73	-308.58	337.81	10.33	-6.65	-2.80

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 19
S-192 POST FLIGHT FIRST STAGE MOMENTS NOVA 1
ALGOL III SCOUT G-1 34/-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981

NOTE... THE FOLLOWING EFFECTIVE OR DELTA PARAMETERS ARE CALCULATED ASSUMING
THE DELTA (RESIDUAL) MOMENTS ARE DUE TO WINDS

TIME (SEC)	ALTITUDE (KILOFEET)	WIND VELOCITY (FT/SEC)	EFFECTIVE WIND VEL (FT/SEC)	DELTA WIND VEL (FT/SEC)	WIND DIRECTION (DEG)	EFFECTIVE WIND DIR (DEG)	DELTA ALPHA (DEG)	DELTA BETA (DEG)
50.00	41.00	113.13	165.89	-52.76	331.69	359.87	-1.18	-1.82
50.50	41.90	99.75	180.94	-81.19	323.66	352.44	-1.69	-.72
51.00	42.80	86.36	148.19	-61.83	315.62	.92	-1.45	-1.36
51.50	43.70	72.97	131.35	-58.38	307.58	346.46	-1.33	-.63
52.00	44.60	59.59	135.19	-75.61	299.55	353.30	-1.66	-.70
52.50	45.50	52.17	133.11	-80.94	294.41	356.50	-1.71	-.76
53.00	46.40	52.55	127.16	-74.61	293.07	354.81	-1.58	-.66
53.50	47.30	52.93	136.69	-83.75	291.72	356.04	-1.70	-.78
54.00	48.20	53.32	129.84	-76.52	290.38	357.87	-1.58	-.81
54.50	49.10	53.70	121.64	-67.94	289.03	356.07	-1.44	-.75
55.00	50.00	52.85	129.28	-76.43	287.38	355.51	-1.53	-.60
55.50	51.00	47.12	116.81	-69.68	283.30	354.86	-1.30	-.59
56.00	52.00	41.38	120.73	-79.34	279.64	354.80	-1.45	-.46
56.50	53.00	35.66	119.44	-83.78	275.70	356.47	-1.44	-.48
57.00	54.00	29.93	113.01	-83.08	271.87	357.35	-1.37	-.35
57.50	55.00	24.85	129.33	-104.48	267.94	358.12	-1.54	-.18
58.00	56.00	23.74	124.18	-100.44	263.52	358.41	-1.47	-.25
58.50	57.00	22.64	115.17	-92.53	259.08	355.69	-1.34	-.14
59.00	58.00	21.54	138.39	-116.85	254.66	358.09	-1.59	-.17
59.50	59.00	20.44	151.57	-131.13	250.23	2.09	-1.72	-.32
60.00	60.00	19.34	156.84	-137.49	245.80	2.90	-1.75	-.30
60.50	61.20	16.72	168.67	-151.95	233.48	4.06	-1.87	-.28
61.00	62.40	13.64	190.44	-176.80	211.71	6.07	-2.07	-.31
61.50	63.60	10.56	245.97	-235.41	203.04	6.49	-2.61	-.32
62.00	64.80	7.49	259.73	-252.24	189.17	8.44	-2.87	-.40
62.50	66.00	4.41	336.64	-332.23	174.40	6.14	-3.42	-.31
63.00	67.20	6.54	449.17	-442.63	159.53	6.05	-4.59	-.37
63.50	68.40	9.46	579.83	-570.36	144.85	7.84	-5.97	-.71
64.00	69.60	12.39	711.27	-698.87	129.77	2.73	-7.43	.11
64.50	70.80	15.32	1393.73	-1378.42	114.89	5.10	-16.76	-.67
65.00	72.00	18.24	7132.43	-7114.19	100.01	44.06	1442.63	-66.79
65.50	73.30	20.41	3680.59	-3660.18	92.86	182.70	18.30	.46
66.00	74.60	22.25	1118.57	-1096.32	88.53	184.30	7.76	.70
66.50	75.90	24.10	799.36	-775.26	84.20	182.86	5.79	.37
67.00	77.20	25.94	634.96	-609.02	79.86	183.73	4.70	.51
67.50	78.50	27.79	493.55	-465.76	75.53	180.86	3.73	.08
68.00	79.80	30.15	372.00	-341.85	75.42	185.30	3.06	.08
68.50	81.10	32.57	303.55	-270.98	78.00	182.00	2.35	.30
69.00	82.40	35.00	292.16	-257.16	79.67	179.83	2.84	.26
69.50	83.70	37.42	276.13	-238.71	81.15	180.82	2.11	.37
70.00	85.00	39.85	248.82	-208.97	82.78	177.97	1.88	.25
70.50	86.30	40.00	266.63	-226.63	86.07	173.47	1.96	-.04
71.00	87.60	40.00	235.40	-195.40	89.54	174.31	1.78	.07
71.50	88.90	40.00	216.35	-176.35	93.01	175.80	1.67	.19
72.00	90.20	40.00	203.38	-163.38	96.40	175.14	1.48	.17
72.50	91.50	40.00	184.82	-144.82	99.05	178.25	1.30	.33
73.00	92.80	38.00	171.34	-133.34	92.40	176.00	1.83	.24

ORIGINAL PAGE IS
OF POOR QUALITY

C-2

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 80

S-182 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34/-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981

NOTE... THE FOLLOWING EFFECTIVE OR DELTA PARAMETERS ARE CALCULATED ASSUMING
THE DELTA (RESIDUAL) MOMENTS ARE DUE TO WINDS

TIME (SEC)	ALTITUDE (KILOFEET)	WIND VELOCITY (FT/SEC)	EFFECTIVE WIND VEL (FT/SEC)	DELTA WIND VEL (FT/SEC)	WIND DIRECTION (DEG)	EFFECTIVE WIND DIR (DEG)	DELTA ALPHA (DEG)	DELTA BETA DEG)
75.00	98.00	30.37	150.93	-120.58	62.76	170.00	1.14	-.09
75.50	99.20	35.34	157.61	-122.27	65.80	164.40	1.16	-.23
76.00	100.40	40.31	146.26	-105.95	68.86	165.39	1.02	-.30
76.50	101.60	45.28	167.00	-121.72	71.90	166.03	1.22	-.07
77.00	102.80	50.25	158.76	-108.52	74.95	163.30	1.14	-.06
77.50	104.00	55.21	167.43	-112.22	78.00	162.84	1.18	-.07
78.00	105.20	56.99	171.46	-114.47	77.91	174.73	1.26	.40
78.50	106.40	58.16	156.46	-98.30	77.23	178.44	1.17	.50
79.00	107.60	59.33	168.03	-108.71	76.55	175.84	1.24	.46
79.50	108.80	60.50	176.15	-115.65	75.87	177.60	1.30	.54
80.00	110.00	61.67	160.39	-98.72	75.10	177.01	1.20	.56
80.50	111.20	58.70	150.02	-91.22	77.16	178.11	1.13	.48
81.00	112.40	56.49	127.64	-71.15	80.17	177.68	.94	.56
81.50	113.60	53.28	118.76	-67.48	83.18	170.10	.86	.34
82.00	114.8	50.07	136.86	-86.79	86.19	178.07	.96	.43
82.50	116.0	46.86	121.93	-75.07	89.20	178.29	.88	.31
83.00	117.20	48.42	164.81	-116.40	91.24	168.39	1.06	.09
83.50	118.40	51.72	139.28	-87.56	92.93	169.08	.88	.24
84.00	119.60	55.02	153.02	-98.00	94.63	176.09	.98	.44
84.50	120.80	58.32	119.50	-61.18	96.38	170.75	.76	.43
85.00	122.00	61.62	127.58	-65.97	98.01	173.75	.79	.53
85.50	123.25	58.78	137.47	-78.69	95.72	176.78	.87	.57
86.00	124.50	55.15	145.34	-90.19	92.91	176.52	.93	.50
86.50	125.75	51.52	147.37	-95.84	90.10	171.18	.93	.28

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 21
S-192 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34/-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - ROLL CHANNEL

TIME	DELTA-L	L(AERO)	L(CONTRL)	L(I)	CL(EFF)	L(AEROP)	CL(EFFP)	DELTA-LP
(SEC)	(FT-LB)	(FT-LB)	(FT-LB)	(FT-LB)		(FT-LB)		(FT-LB)
0.00	40.	0.	-0.	40.	8888888888	-0.	8888888888	40.
.50	269.	1.	-229.	9.	4.4095	-1.	4.4871	270.
1.00	260.	2.	-310.	-48.	2.1300	-0.	2.1476	262.
1.50	289.	3.	-239.	-7.	1.2506	0.	1.2683	232.
2.00	117.	5.	-170.	-47.	.4811	1.	.4989	182.
2.50	96.	6.	-54.	48.	.3140	1.	.3318	101.
3.00	89.	7.	-102.	-6.	.2427	-0.	.2606	95.
3.50	55.	8.	-66.	-3.	.1286	0.	.1465	63.
4.00	106.	9.	-62.	52.	.2179	-0.	.2359	115.
4.50	192.	9.	-194.	8.	.3502	-1.	.3683	202.
5.00	217.	11.	-266.	-38.	.3560	-0.	.3742	228.
5.50	232.	13.	-246.	0.	.3202	0.	.3384	245.
6.00	231.	15.	-257.	-11.	.2761	-0.	.2944	246.
6.50	201.	18.	-217.	2.	.2115	0.	.2298	219.
7.00	169.	20.	-194.	-5.	.1586	0.	.1770	188.
7.50	158.	22.	-155.	25.	.1343	0.	.1527	180.
8.00	184.	23.	-196.	11.	.1484	-0.	.1600	208.
8.50	222.	26.	-252.	-4.	.1678	-0.	.1763	248.
9.00	216.	28.	-269.	-25.	.1423	-0.	.1608	244.
9.50	230.	31.	-240.	20.	.1409	0.	.1594	260.
10.00	256.	32.	-280.	8.	.1464	-0.	.1650	288.
10.50	298.	36.	-344.	-10.	.1547	-0.	.1734	334.
11.00	322.	39.	-366.	-4.	.1526	-0.	.1713	362.
11.50	340.	43.	-385.	-2.	.1483	-0.	.1672	383.
12.00	329.	47.	-407.	-31.	.1330	0.	.1519	376.
12.50	313.	51.	-345.	19.	.1179	1.	.1360	363.
13.00	333.	54.	-377.	10.	.1176	-0.	.1365	387.
13.50	376.	57.	-441.	-7.	.1248	-0.	.1438	434.
14.00	398.	61.	-458.	2.	.1244	-0.	.1435	459.
14.50	419.	65.	-487.	-3.	.1239	-0.	.1438	484.
15.00	418.	69.	-493.	-6.	.1174	0.	.1368	487.
15.50	441.	74.	-506.	10.	.1158	0.	.1353	516.
16.00	467.	73.	-546.	0.	.1149	-0.	.1345	547.
16.50	486.	85.	-571.	-0.	.1187	-0.	.1384	571.
17.00	485.	91.	-581.	-5.	.1063	0.	.1261	576.
17.50	473.	96.	-566.	4.	.0982	0.	.1188	569.
18.00	477.	102.	-578.	1.	.0948	0.	.1142	579.
18.50	491.	107.	-596.	3.	.0924	0.	.1125	598.
19.00	496.	113.	-613.	-3.	.0898	0.	.1094	609.
19.50	495.	119.	-608.	6.	.0851	0.	.1055	614.
20.00	534.	124.	-646.	12.	.0880	-0.	.1084	658.
20.50	612.	130.	-750.	-8.	.0965	-1.	.1171	743.
21.00	616.	137.	-778.	-25.	.0932	1.	.1139	753.
21.50	579.	144.	-712.	10.	.0840	1.	.1048	722.
22.00	587.	150.	-736.	1.	.0819	1.	.1028	736.
22.50	595.	156.	-743.	8.	.0800	0.	.1010	751.
23.00	658.	163.	-826.	-6.	.0853	-0.	.1064	821.
23.50	650.	170.	-828.	-7.	.0815	0.	.1027	820.
24.00	608.	178.	-794.	-7.	.0737	1.	.0952	786.
24.50	617.	185.	-805.	-3.	.0723	0.	.0939	801.

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 22

S-198 POST FLIGHT FIRST STAGE MOMENTS NOVA 1
ALGOL III SCOUT G-1 34°-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - ROLL CHANNEL

TIME	DELTA-L	L(AERO)	L(CONTRL)	L(I)	CL(EFF)	L(AEROP)	CL(EFFP)	DELTA-LP
(SEC)	(FT-LB)	(FT-LB)	(FT-LB)	(FT-LB)		(FT-LB)		(FT-LB)
25.00	635.	192.	-819.	9.	.0721	1.	.0930	887.
25.50	719.	200.	-917.	2.	.0789	-0.	.1000	980.
26.00	761.	209.	-984.	-13.	.0808	-0.	.1030	971.
26.50	716.	219.	-948.	-13.	.0735	1.	.0980	934.
27.00	614.	229.	-848.	-5.	.0611	2.	.0834	842.
27.50	590.	237.	-816.	13.	.0569	1.	.0790	887.
28.00	671.	246.	-909.	8.	.0629	-0.	.0860	917.
28.50	778.	255.	-1046.	-12.	.0709	-0.	.0942	1034.
29.00	768.	265.	-1027.	6.	.0680	0.	.0915	1033.
29.50	778.	275.	-1064.	-11.	.0671	0.	.0908	1053.
30.00	663.	284.	-969.	8.	.0582	1.	.0820	976.
30.50	653.	291.	-942.	2.	.0534	1.	.0778	944.
31.00	659.	298.	-957.	1.	.0525	0.	.0763	958.
31.50	656.	306.	-967.	-5.	.0510	0.	.0747	961.
32.00	659.	312.	-962.	9.	.0500	0.	.0738	971.
32.50	713.	316.	-1024.	3.	.0528	-0.	.0762	1028.
33.00	740.	321.	-1066.	-5.	.0535	-0.	.0768	1061.
33.50	770.	326.	-1092.	5.	.0544	-0.	.0775	1096.
34.00	810.	329.	-1144.	-4.	.0560	-0.	.0780	1140.
34.50	810.	333.	-1143.	-0.	.0548	0.	.0773	1142.
35.00	827.	335.	-1156.	6.	.0547	-0.	.0769	1162.
35.50	852.	336.	-1192.	-4.	.0552	-0.	.0770	1188.
36.00	885.	337.	-1223.	-1.	.0562	0.	.0776	1222.
36.50	884.	338.	-1219.	2.	.0550	-0.	.0761	1222.
37.00	921.	338.	-1256.	4.	.0563	-0.	.0770	1260.
37.50	996.	333.	-1332.	3.	.0607	-1.	.0800	1335.
38.00	1051.	339.	-1403.	-13.	.0610	-0.	.0810	1390.
38.50	1043.	339.	-1380.	2.	.0602	0.	.0797	1381.
39.00	1040.	338.	-1378.	0.	.0590	0.	.0781	1378.
39.50	1050.	337.	-1388.	-2.	.0585	0.	.0772	1386.
40.00	1039.	335.	-1375.	-1.	.0569	0.	.0752	1374.
40.50	1003.	330.	-1335.	-1.	.0540	0.	.0717	1333.
41.00	1014.	325.	-1338.	1.	.0537	0.	.0709	1339.
41.50	990.	319.	-1311.	-2.	.0516	0.	.0682	1309.
42.00	942.	313.	-1251.	4.	.0483	0.	.0643	1255.
42.50	924.	307.	-1238.	1.	.0466	0.	.0621	1230.
43.00	916.	301.	-1218.	-1.	.0455	0.	.0605	1217.
43.50	893.	295.	-1187.	1.	.0437	0.	.0581	1187.
44.00	870.	288.	-1163.	-4.	.0420	0.	.0559	1159.
44.50	863.	282.	-1150.	0.	.0413	0.	.0546	1150.
45.00	860.	275.	-1141.	-6.	.0403	0.	.0531	1134.
45.50	811.	268.	-1076.	3.	.0377	1.	.0501	1078.
46.00	783.	262.	-1040.	4.	.0362	0.	.0483	1044.
46.50	762.	256.	-1026.	-9.	.0350	0.	.0467	1018.
47.00	703.	251.	-953.	1.	.0321	1.	.0435	954.
47.50	696.	245.	-930.	11.	.0315	0.	.0486	940.
48.00	718.	240.	-963.	-5.	.0323	-0.	.0431	958.
48.50	715.	237.	-963.	-11.	.0320	0.	.0428	952.
49.00	422.	234.	-654.	1.	.0187	1.	.0281	655.
49.50	416.	230.	-644.	2.	.0184	0.	.0285	646.

ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

Figure 6 (continued)
Sample Problem Output

RUN NO. 1 PAGE NO. 83
S-198 POST FLIGHT FIRST STAGE MOMENTS NOVA I
ALGOL III SCOUT G-1 34.-40 HEATSHIELD
OLD AERODYNAMICS 18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - ROLL CHANNEL

TIME (SEC)	DELTA-L (FT-LB)	L(AERO) (FT-LB)	L(CONTRL) (FT-LB)	L(I) (FT-LB)	CL(EFF)	L(AEROP) (FT-LB)	CL(EFFP)	DELTA-LP (FT-LB)
50.00	436.	226.	-659.	2.	.0191	0.	.0290	661
50.50	430.	222.	-657.	-5.	.0189	0.	.0286	651.
51.00	378.	218.	-597.	-1.	.0167	0.	.0262	596.
51.50	371.	213.	-580.	4.	.0164	0.	.0258	584.
52.00	324.	209.	-535.	-2.	.0143	0.	.0236	533.
52.50	326.	205.	-532.	-2.	.0144	0.	.0236	529.
53.00	312.	201.	-508.	4.	.0138	0.	.0227	518.
53.50	347.	197.	-535.	10.	.0155	0.	.0242	544.
54.00	357.	192.	-569.	-20.	.0159	-0.	.0245	549.
54.50	333.	189.	-584.	-3.	.0148	0.	.0233	521.
55.00	314.	186.	-498.	2.	.0141	0.	.0223	499.
55.50	306.	180.	-497.	-11.	.0139	0.	.0220	486.
56.00	348.	175.	-514.	9.	.0159	0.	.0239	523.
56.50	360.	170.	-537.	-7.	.0167	-0.	.0245	530.
57.00	350.	165.	-525.	-9.	.0164	0.	.0241	515.
57.50	315.	160.	-466.	0.	.0140	0.	.0224	474.
58.00	332.	155.	-486.	1.	.0150	0.	.0233	487.
58.50	322.	150.	-474.	-8.	.0156	-0.	.0228	472.
59.00	416.	146.	-557.	5.	.0204	-0.	.0276	563.
59.50	409.	143.	-558.	-6.	.0203	0.	.0274	558.
60.00	378.	139.	-516.	-1.	.0189	0.	.0259	515.
60.50	359.	134.	-481.	12.	.0185	0.	.0255	493.
61.00	364.	129.	-494.	-1.	.0193	0.	.0262	492.
61.50	343.	124.	-457.	10.	.0188	-0.	.0256	467.
62.00	338.	119.	-456.	-7.	.0186	0.	.0254	449.
62.50	305.	114.	-416.	3.	.0178	0.	.0244	419.
63.00	299.	109.	-415.	-6.	.0181	0.	.0246	408.
63.50	282.	104.	-389.	-3.	.0176	0.	.0241	386.
64.00	266.	100.	-364.	2.	.0166	0.	.0230	356.
64.50	251.	95.	-347.	-1.	.0168	0.	.0232	346.
65.00	243.	90.	-331.	2.	.0169	0.	.0232	333.
65.50	224.	86.	-311.	-1.	.0162	0.	.0226	310.
66.00	201.	83.	-280.	3.	.0151	0.	.0214	283.
66.50	188.	73.	-262.	5.	.0148	0.	.0210	267.
67.00	174.	75.	-253.	-4.	.0143	0.	.0205	248.
67.50	165.	71.	-231.	6.	.0143	0.	.0204	236.
68.00	157.	67.	-227.	-3.	.0142	0.	.0203	224.
68.50	142.	64	-205.	1.	.0136	0.	.0196	206.
69.00	135.	60.	-198.	-3.	.0134	0.	.0196	195.
69.50	133.	56.	-187.	1.	.0141	-0.	.0201	189.
70.00	124.	53.	-173.	-2.	.0141	0.	.0200	177.
70.50	114.	50.	-159.	5.	.0134	0.	.0194	164.
71.00	109.	48.	-157.	0.	.0135	-0.	.0196	158.
71.50	101.	46.	-148.	-1.	.0132	-0.	.0191	147.
72.00	91.	44.	-136.	-1.	.0124	0.	.0183	134.
72.50	83.	41.	-121.	2.	.0119	0.	.0178	124.
73.00	78.	39.	-116.	1.	.0118	-0.	.0178	117.
73.50	76.	37.	-113.	-1.	.0122	-0.	.0181	112.
74.00	68.	35.	-105.	-2.	.0116	0.	.0176	108.
74.50	67.	32.	-96.	4.	.0123	0.	.0182	89.

Figure 6 (concluded)
Sample Problem Output

```
     RUN NO.     1                                                         PAGE NO.   84
S-198 POST FLIGHT FIRST STAGE MOMENTS  NOVA 1
ALGOL III SCOUT G-1  34/-40 HEATSHIELD
OLD AEROD. AMIC9  18 AUG 1981
FIRST STAGE MOMENT DISTURBANCE - ROLL CHANNEL
```

TIME (SEC)	DELTA-L (FT-LB)	L(AERO) (FT-LB)	L(CONTRL) (FT-LB)	L(I) (FT-LB)	CL(EFF)	L(AEROP) (FT-LB)	CL(EFFP)	DELTA-LP (FT-LB)
75.00	61.	30	-35.	-4.	.0121	-0.	.0188	91.
75.50	63.	29.	-90.	2.	.0131	0.	.0191	98.
76.00	62.	27.	-90.	0.	.0136	-0.	.0195	90.
76 50	55.	26.	-87.	-6.	.0125	0.	.0185	81.
77.00	53.	25.	-75.	2.	.0126	0.	.0186	78.
77.50	49.	24.	-71.	1.	.0123	-0.	.0183	73.
78.00	43.	22.	-69.	-3.	.0116	0.	.0176	66.
78.50	38.	21.	-60.	-0.	.0109	0.	.0169	60.
79.00	38.	20.	-55.	3.	.0115	0.	.0175	58.
79.50	35.	19.	-53.	1.	.0114	-0.	.0174	54.
80.00	31.	17.	-50.	-2.	.0107	0.	.0167	48.
80.50	30.	17.	-46.	0.	.0108	0.	.0168	46.
81.00	27.	16.	-43.	-0.	.0104	0.	.0164	43.
81.50	27.	15.	-41.	1.	.0107	0.	.0168	42.
82.00	23.	15.	-39.	-1.	.0098	0.	.0159	38.
82.50	23.	14.	-36.	1.	.0100	0.	.0161	37.
83.00	21.	13.	-34.	-0.	.0095	0.	.0156	34.
83.50	19.	12.	-31.	0.	.0092	0.	.0153	31.
84.00	19.	12.	-30.	1.	.0099	0.	.0160	31.
84.50	17.	11.	-28.	-0.	.0097	0.	.0158	28.
85.00	18.	10.	-27.	1.	.0104	0.	.0166	28.
85.50	16.	10.	-26.	-0.	.0102	-0.	.0164	26.
86.00	13.	9.	-24.	-2.	.0087	0.	.0148	23.
86.50	9.	9.	-20.	-2.	.0061	0.	.0128	18.

ORIGINAL PAGE IS
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Figure 7
Punched Card Output

```
  $$   TIME
TAUM=       0.000,     0.000,      .500,     1.000,     1.500,     2.000,$$
            2.500,     3.000,     3.500,     4.000,     4.500,     5.000,$$
            5.500,     6.000,     6.500,     7.000,     7.500,     8.000,$$
            8.500,     9.000,     9.500,    10.000,    10.500,    11.000,$$
           11.500,    12.000,    12.500,    13.000,    13.500,    14.000,$$
TAUM=      13.500,    14.000,    14.500,    15.000,    15.500,    16.000,$$
           16.500,    17.000,    17.500,    18.000,    18.500,    19.000,$$
           19.500,    20.000,    20.500,    21.000,    21.500,    22.000,$$
           22.500,    23.000,    23.500,    24.000,    24.500,    25.000,$$
           25.500,    26.000,    26.500,    27.000,    27.500,    28.000,$$
TAUM=      27.500,    28.000,    28.500,    29.000,    29.500,    30.000,$$
           30.500,    31.000,    31.500,    32.000,    32.500,    33.000,$$
           33.500,    34.000,    34.500,    35.000,    35.500,    36.000,$$
           36.500,    37.000,    37.500,    38.000,    38.500,    39.000,$$
           39.500,    40.000,    40.500,    41.000,    41.500,    42.000,$$
TAUM=      41.500,    42.000,    42.500,    43.000,    43.500,    44.000,$$
           44.500,    45.000,    45.500,    46.000,    46.500,    47.000,$$
           47.500,    48.000,    48.500,    49.000,    49.500,    50.000,$$
           50.500,    51.000,    51.500,    52.000,    52.500,    53.000,$$
           53.500,    54.000,    54.500,    55.000,    55.500,    56.000,$$
TAUM=      55.500,    56.000,    56.500,    57.000,    57.500,    58.000,$$
           58.500,    59.000,    59.500,    60.000,    60.500,    61.000,$$
           61.500,    62.000,    62.500,    63.000,    63.500,    64.000,$$
           64.500,    65.000,    65.500,    66.000,    66.500,    67.000,$$
           67.500,    68.000,    68.500,    69.000,    69.500,    70.000,$$
TAUM=      69.500,    70.000,    70.500,    71.000,    71.500,    72.000,$$
           72.500,    73.000,    73.500,    74.000,    74.500,    75.000,$$
           75.500,    76.000,    76.500,    77.000,    77.500,    78.000,$$
           78.500,    79.000,    79.500,    80.000,    80.500,    81.000,$$
           81.500,    82.000,    82.500,    83.000,    83.500,    84.000,$$
TAUM=      83.500,    84.000,    84.500,    85.000,    85.500,    86.000,$$
           86.500,     0.000,     0.000,     0.000,     0.000,     0.000,$$
```

Figure 7 (continued)
Punched Card Output

```
$$     PITCH MOMENT
DPITCH=     0.000, -2461.091,  4562.800,  1175.254,  2895.216,  3414.185,$$
         2523.473,  1402.914,  1867.846,  1888.502,  1510.025,  1077.782,$$
          839.940,  1033.593,  2243.197,  1445.828,   643.814,   100.192,$$
         -335.764,   218.560,   247.096,   721.645,  1700.474,  1947.097,$$
         1379.929,  -594.848,  -251.031,   866.007,  1691.656,   651.376,$$
DPITCH=  1691.656,   651.376,  -390.450,  -212.072,  -942.319,  1406.877,$$
         2763.190,  2032.211,  1250.784,  1664.787,  1851.504, -2219.159,$$
        -4833.205, -2975.096,  -998.257,  -509.462,  -968.239,   385.820,$$
           85.185, -5658.355, -5304.293, -7406.947,-10686.798,-10591.846,$$
       -10256.346, -4625.005, -4364.440, -2033.256, -3283.584, -6330.737,$$
DPITCH= -3283.584, -6330.737, -4679.011, -5226.837, -4442.326, -3192.028,$$
        -3079.939, -3981.265, -6302.858, -5605.203, -6482.595, -6014.198,$$
        -3772.550, -3766.121, -3345.221, -1119.287,   297.973,   179.631,$$
          726.852,  1300.344,  2757.956,  1541.977,   565.762,  1036.355,$$
         -862.838, -2394.161, -1509.150, -1386.288, -2792.367, -2348.455,$$
DPITCH= -2792.367, -2348.455, -2801.935, -1863.062, -3870.339, -3062.553,$$
        -2867.232, -4714.413, -3804.112, -4442.197, -5824.069, -5302.354,$$
        -4464.573, -5912.051, -3261.789, -4671.123, -5178.586, -3843.234,$$
        -7367.315, -7091.365, -6735.211, -8862.328, -9294.356, -8599.710,$$
         9439.098, -8584.275, -7626.734, -8074.201, -6903.170, -7216.307,$$
DPITCH= -6903.170, -7216.307, -7039.112, -6551.011, -7347.133, -6707.644,$$
        -5707.509, -6393.311, -6232.185, -5602.282, -5190.557, -4864.051,$$
        -5171.986, -4083.641, -4323.444, -4582.860, -4189.932, -3074.872,$$
        -3266.628, -3522.510, -3187.963, -2430.803, -2735.533, -2800.790,$$
        -2537.680, -2109.732, -1876.535, -1937.422, -1892.072, -1709.099,$$
DPITCH= -1892.072, -1709.099, -1894.267, -1666.453, -1529.231, -1424.084,$$
        -1255.279, -1167.054, -1186.546,  -807.543,  -856.165,  -982.493,$$
         -994.161,  -839.685, -1036.654,  -942.765,  -951.235,  -997.225,$$
         -875.715,  -902.267,  -907.459,  -783.994,  -701.694,  -557.745,$$
         -478.246,  -528.821,  -432.173,  -562.041,  -439.149,  -464.860,$$
DPITCH=  -439.149,  -464.860,  -319.139,  -321.276,  -345.083,  -357.860,$$
         -345.592,     0.000,     0.000,     0.000,     0.000,     0.000,$$
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ORIGINAL PAGE IS
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Figure 7 (continued)
Punched Card Output

```
     $$   PITCH THRUST MIS
 DPITCH=     0.000,     0.000,      .086,      .026,      .067,      .082,$$
              .062,      .035,      .047,      .048,      .039,      .028,$$
              .022,      .027,      .058,      .038,      .017,      .003,$$
            -.009,      .006,      .007,      .019,      .045,      .052,$$
              .037,     -.016,     -.007,      .023,      .044,      .017,$$
 DPITCH=      .044,      .017,     -.010,     -.006,     -.024,      .036,$$
              .071,      .053,      .032,      .043,      .048,     -.058,$$
             -.126,     -.078,     -.026,     -.013,     -.026,      .010,$$
              .002,     -.149,     -.139,     -.194,     -.278,     -.274,$$
             -.263,     -.118,     -.110,     -.051,     -.082,     -.156,$$
 DPITCH=     -.082,     -.156,     -.114,     -.127,     -.107,     -.076,$$
             -.073,     -.094,     -.147,     -.130,     -.149,     -.137,$$
             -.085,     -.085,     -.075,     -.025,      .007,      .004,$$
              .016,      .028,      .058,      .032,      .012,      .021,$$
             -.018,     -.048,     -.030,     -.027,     -.055,     -.046,$$
 DPITCH=     -.055,     -.046,     -.054,     -.036,     -.073,     -.057,$$
             -.053,     -.087,     -.069,     -.080,     -.104,     -.094,$$
             -.079,     -.103,     -.056,     -.080,     -.088,     -.065,$$
             -.123,     -.118,     -.111,     -.145,     -.151,     -.138,$$
             -.150,     -.135,     -.119,     -.124,     -.105,     -.109,$$
 DPITCH=     -.105,     -.109,     -.105,     -.097,     -.107,     -.097,$$
             -.081,     -.090,     -.088,     -.082,     -.078,     -.075,$$
             -.082,     -.066,     -.073,     -.081,     -.078,     -.060,$$
             -.067,     -.076,     -.073,     -.059,     -.070,     -.076,$$
             -.073,     -.064,     -.061,     -.067,     -.069,     -.066,$$
 DPITCH=     -.069,     -.066,     -.078,     -.073,     -.072,     -.073,$$
             -.069,     -.068,     -.075,     -.055,     -.063,     -.077,$$
             -.085,     -.078,     -.106,     -.108,     -.119,     -.135,$$
             -.129,     -.147,     -.164,     -.159,     -.157,     -.134,$$
             -.125,     -.152,     -.137,     -.200,     -.171,     -.195,$$
 DPITCH=     -.171,     -.195,     -.146,     -.160,     -.190,     -.219,$$
             -.229,     0.000,     0.000,     0.000,     0.000,     0.000,$$
```

Figure 7 (continued)
Punched Card Output

```
     $$    YAW MOMENT
DYAW=       0.000,   248.083,  3592.334,  -685.182,  -694.823,  1080.798,$$
          171.855,  -978.065, -2007.596, -2313.283, -1768.650, -1741.244,$$
        -2190.683, -2028.844, -2681.976, -2859.021, -3308.951, -2871.933,$$
        -3479.466, -4870.089, -3719.532, -2866.870, -3089.611, -4255.178,$$
        -3664.888, -5538.186, -4918.140, -4594.431, -2632.024, -1620.571,$$
DYAW=   -2632.024, -1620.571,  -585.302, -1095.335,    -5.680,   264.263,$$
         -867..94,  -161.093,  -659.556,  -840.717, -1996.197,  -749.861,$$
        -2688.376, -3166.032, -1120.403, -3770.076, -4892.239, -5374.886,$$
        -1965.486,   247.053, -5139.233, -8699.500, -6523.617, -9077.672,$$
        -9032.273,-11901.693, -8364.126, -9441.659,-13912.301,-12339.693,$$
DYAW=  -13912.301,-12339.693,-11596.547,-18482.523,-15804.964,-21449.263,$$
       -21225.621,-20187.884,-20393.448,-18297.994,-14170.519,-11862.851,$$
       -10189.932, -9903.511, -9079.696, -9467.534,-10195.021,-10769.036,$$
       -11505.154,-12752.648,-12483.194,-12490.343,-11068.843,-11069.077,$$
        -8450.803, -9148.170, -6883.343, -4785.409, -2968.421,  -844.828,$$
DYAW=   -2968.421,  -844.828,   447.149,  1919.147,   942.370,  1174.365,$$
         1626.407,  1912.246,  1814.597,  2145.185,  1434.015,  3220.450,$$
         2782.736,  3946.796,  3871.409,  4350.628,  4361.561,  5770.531,$$
         4165.010,  8442.653,  3471.284,  4689.600,  4983.442,  4591.419,$$
         4858.810,  5398.808,  5059.022,  4619.889,  3878.192,  3019.494,$$
DYAW=    3878.192,  3019.494,  2763.249,  2330.866,  1282.850,  1671.139,$$
         1028.411,  1044.217,  1748.823,  1452.260,  1202.171,  1159.754,$$
         1025.930,  1205.830,   689.455,   677.861,   847.437,   129.159,$$
          345.430,   -44.517,   280.677,   493.151,   373.704,   539.682,$$
          219.813,   753.621,   527.656,   410.627,   543.008,   403.105,$$
DYAW=     543.008,   403.105,    56.065,   192.242,   333.066,   304.765,$$
          494.773,   367.417,   -86.110,   264.509,   -75.034,   -34.407,$$
         -189.950,  -357.419,   -23.652,   -15.753,   -22.573,   409.143,$$
          475.226,   409.115,   460.153,   440.963,   377.798,   423.746,$$
          257.547,   308.765,   222.008,    79.730,   158.097,   258.263,$$
DYAW=     158.097,   258.263,   235.395,   270.082,   275.001,   233.922,$$
          129.786,     0.000,     0.000,     0.000,     0.000,     0.000,$$
```

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Figure 7 (continued)
Punched Card Output

```
    $$   YAW THRUST MIS
DYAW=     0.000,    0.000,    .067,   -.015,   -.016,    .026,$$
           .004,   -.024,   -.051,   -.059,   -.045,   -.045,$$
          -.056,   -.052,   -.070,   -.074,   -.087,   -.075,$$
          -.092,   -.129,   -.099,   -.076,   -.082,   -.113,$$
          -.097,   -.147,   -.130,   -.121,   -.069,   -.042,$$
DYAW=     -.059,   -.042,   -.015,   -.028,   -.000,    .007,$$
          -.022,   -.004,   -.017,   -.022,   -.052,   -.020,$$
          -.070,   -.083,   -.029,   -.099,   -.129,   -.142,$$
          -.052,    .007,   -.135,   -.228,   -.170,   -.234,$$
          -.231,   -.303,   -.211,   -.236,   -.345,   -.304,$$
DYAW=     -.345,   -.304,   -.283,   -.448,   -.380,   -.512,$$
          -.503,   -.475,   -.476,   -.424,   -.326,   -.270,$$
          -.231,   -.222,   -.202,   -.209,   -.224,   -.235,$$
          -.249,   -.273,   -.265,   -.262,   -.230,   -.228,$$
          -.172,   -.185,   -.138,   -.095,   -.058,   -.016,$$
DYAW=     -.058,   -.016,    .009,    .037     .018,    .022,$$
           .030,    .035,    .033,    .039,    .026,    .057,$$
           .049,    .069,    .067,    .075,    .074,    .097,$$
           .070,    .140,    .057,    .077,    .081,    .074,$$
           .077,    .085,    .079,    .071,    .059,    .046,$$
DYAW=      .059,    .046,    .041,    .034,    .019,    .024,$$
           .015,    .015,    .025,    .021,    .018,    .018,$$
           .016,    .020,    .012,    .012,    .016,    .003,$$
           .007,   -.001,    .006,    .012,    .010,    .015,$$
           .006,    .023,    .017,    .014,    .020,    .016,$$
DYAW=      .020,    .016,    .002,    .008,    .016,    .016,$$
           .027,    .021,   -.005,    .018,   -.005,   -.003,$$
          -.016,   -.033,   -.002,   -.002,   -.003,    .055,$$
           .070,    .066,    .083,    .090,    .084,    .102,$$
           .068,    .089,    .071,    .028,    .062,    .109,$$
DYAW=      .062,    .103,    .107,    .135,    .151,    .143,$$
           .086,    0.000,   0.000,   0.000,   0.000,   0.000,$$
```

Figure 7 (concluded)
Punched Card Output

```
      $$   ROLL MOMENT
   DROLL=      0.000,     39.568,    269.842,    261.806,    231.909,    121.632,$$
             101.130,     95.297,     62.523,    115.026,    202.044,    228.058,$$
             244.757,    246.426,    218.504,    188.414,    179.967,    207.837,$$
             247.878,    244.431,    260.462,    288.386,    334.491,    361.505,$$
             383.081,    375.635,    363.210,    387.276,    434.088,    459.226,$$
   DROLL=    434.088,    459.226,    484.177,    487.206,    515.756,    546.514,$$
             571.108,    575.448,    568.948,    578.766,    598.170,    609.091,$$
             613.555,    657.956,    742.585,    753.182,    722.226,    736.294,$$
             751.403,    820.673,    819.990,    785.804,    801.443,    827.063,$$
             919.539,    970.552,    934.144,    841.783,    826.570,    916.847,$$
   DROLL=    826.570,    916.847,   1033.798,   1033.167,   1053.435,    976.429,$$
             943.761,    957.510,    961.453,    970.516,   1029.173,   1061.156,$$
            1096.085,   1139.643,   1142.392,   1161.684,   1187.762,   1221.806,$$
            1221.556,   1259.979,   1335.132,   1390.280,   1381.281,   1377.665,$$
            1386.090,   1373.943,   1332.828,   1338.840,   1308.910,   1254.633,$$
   DROLL=   1308.910,   1254.633,   1230.234,   1216.903,   1187.492,   1158.562,$$
            1150.438,   1134.216,   1077.997,   1044.381,   1017.539,    953.569,$$
             940.146,    958.453,    951.817,    654.927,    645.635,    661.434,$$
             651.368,    595.553,    583.690,    532.740,    529.271,    512.282,$$
             544.010,    549.409,    520.905,    499.136,    486.099,    522.900,$$
   DROLL=    486.099,    522.980,    529.854,    514.821,    474.466,    487.087,$$
             471.736,    562.622,    552.236,    515.489,    493.494,    492.480,$$
             466.996,    448.757,    418.754,    408.456,    385.840,    355.509,$$
             345.592,    332.993,    310.016,    282.988,    266.890,    248.494,$$
             236.374,    224.131,    205.922,    194.809,    188.812,    177.111,$$
   DROLL=    188.812,    177.111,    163.925,    157.590,    147.192,    134.334,$$
             123.816,    116.859,    112.331,    102.045,     98.782,     91.131,$$
              92.186,     89.826,     81.186,     77.686,     72.587,     65.817,$$
              59.620,     58.037,     53.878,     47.881,     46.301,     43.232,$$
              42.125,     37.994,     36.544,     33.628,     31.095,     30.623,$$
   DROLL=     31.095,     30.623,     28.350,     27.816,     26.201,     22.502,$$
              17.574,      0.000,      0.000,      0.000,      0.000,      0.000,$$
```

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Figure 8
CALCOMP Plot - Pitch Moments

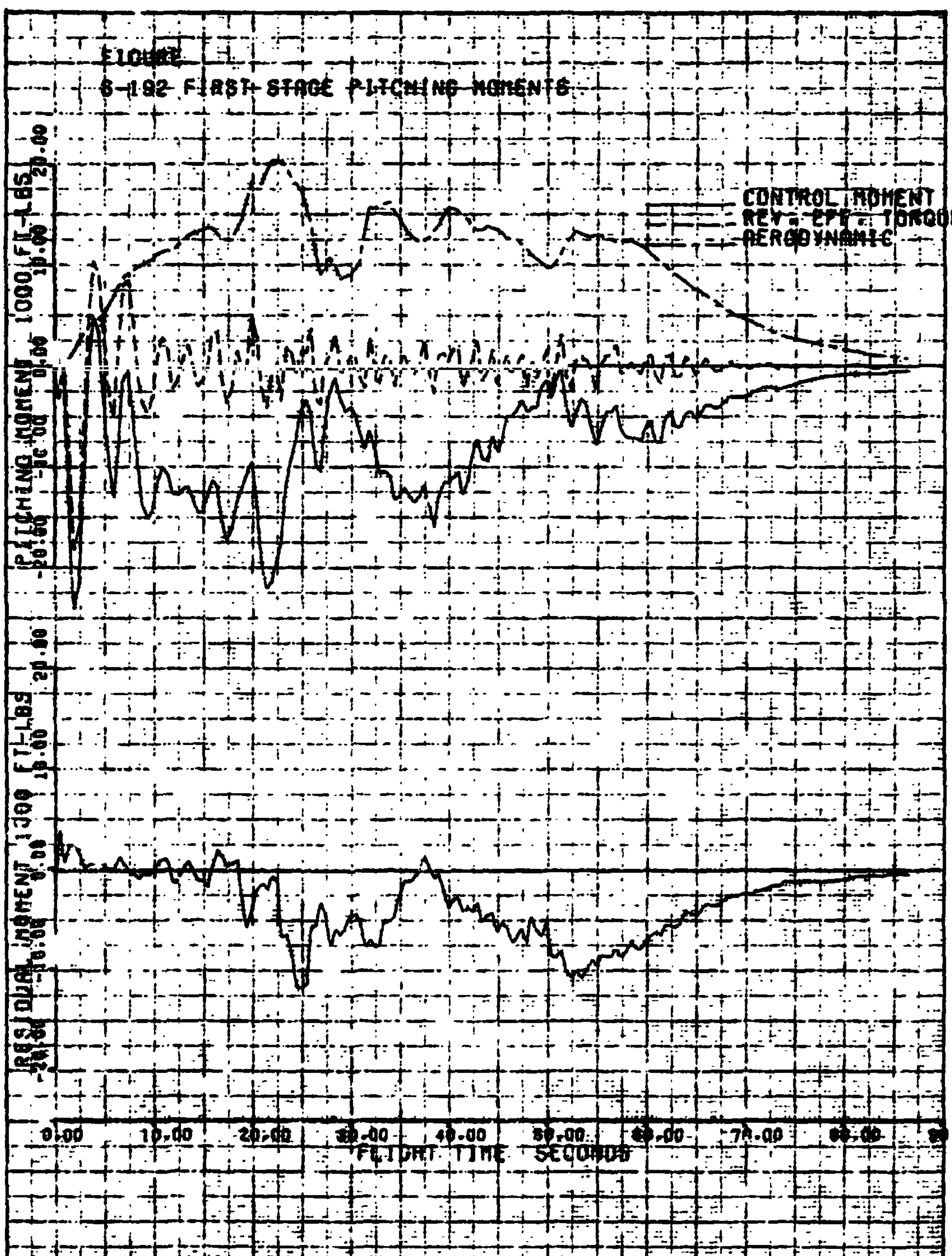

Figure 9

CALCOMP Plot - Thrust Misalignment

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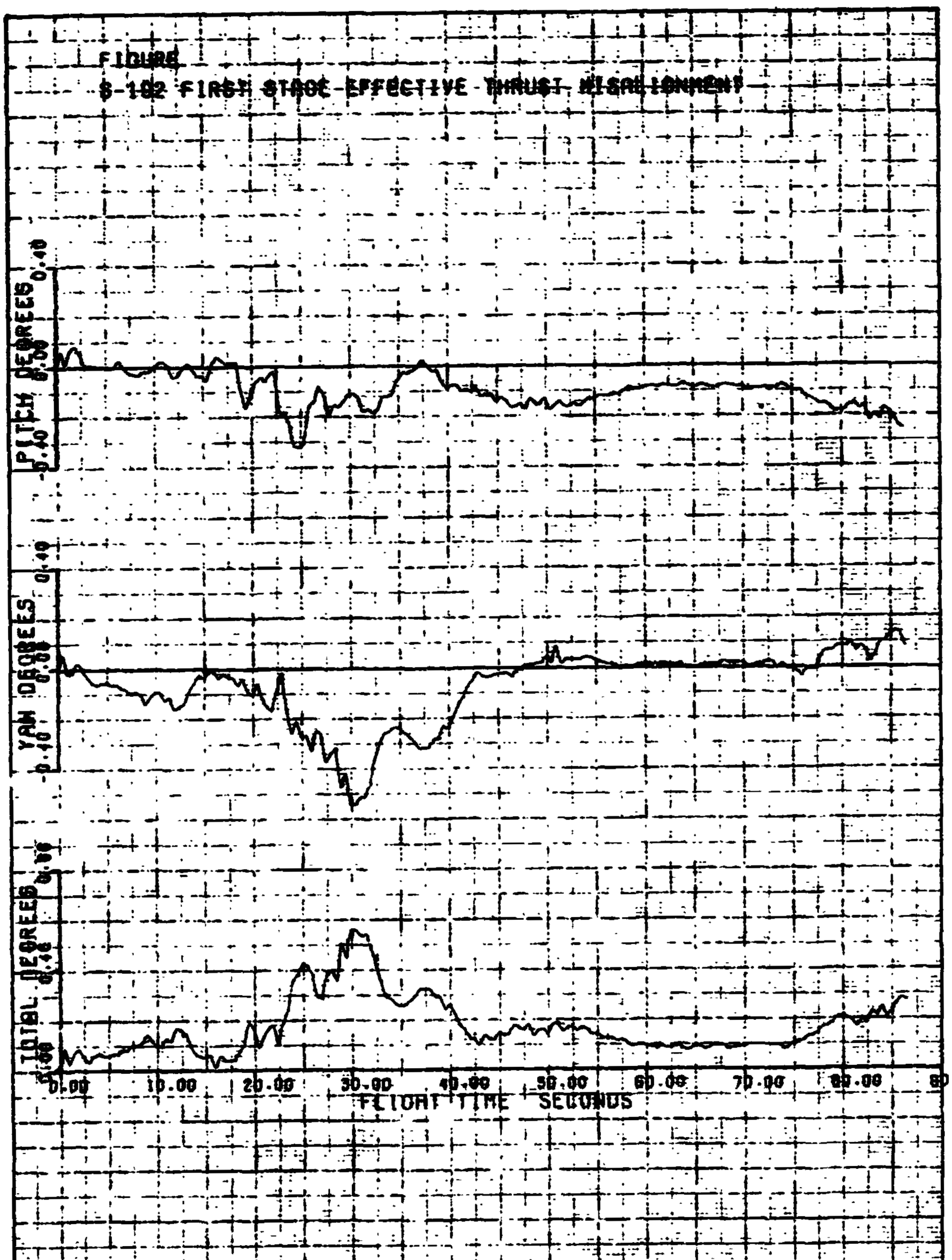

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Figure 10
CALCOMP Plot - Wind Velocity

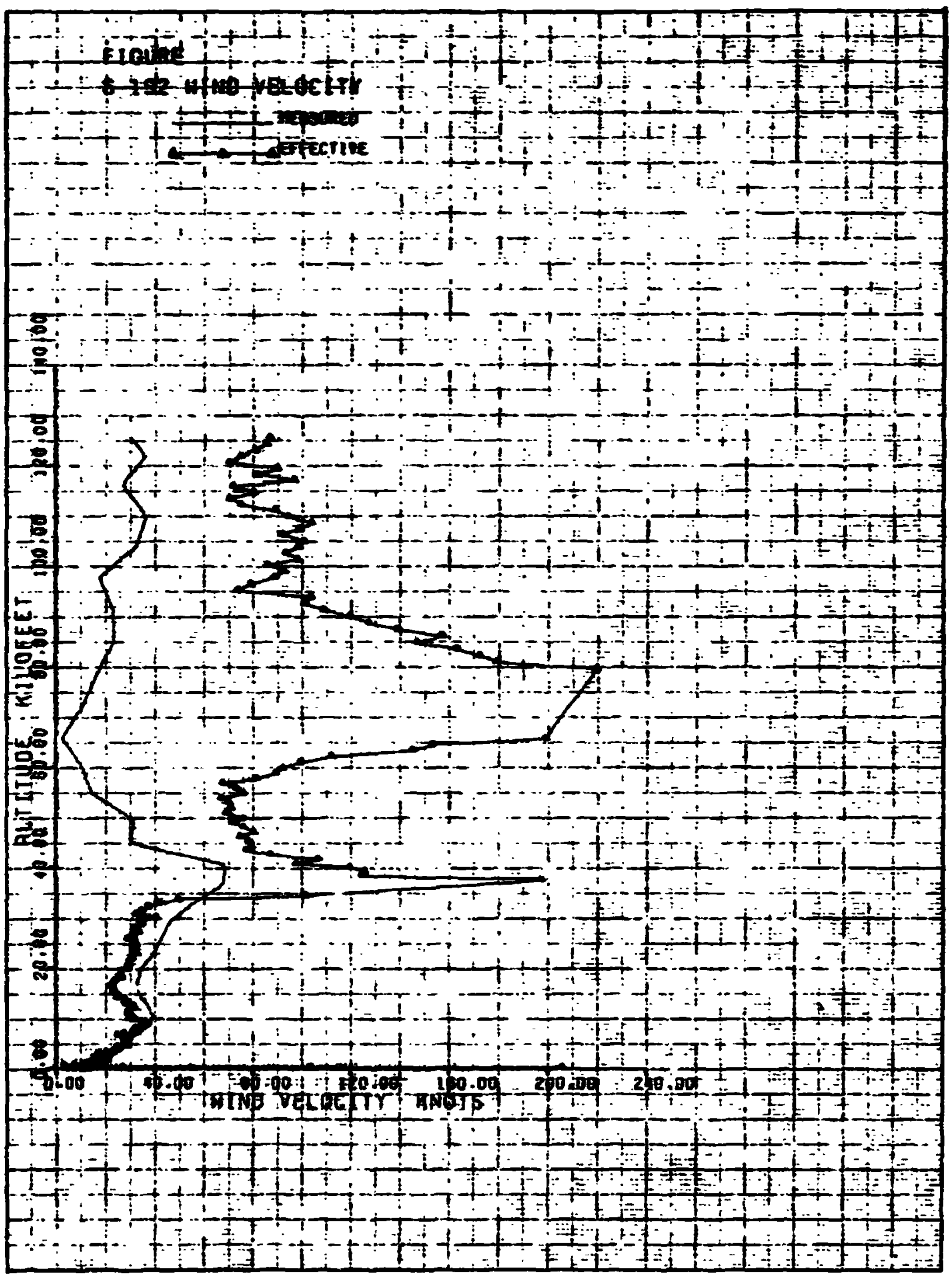

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Figure 11

CALCOMP Plot - Wind Direction

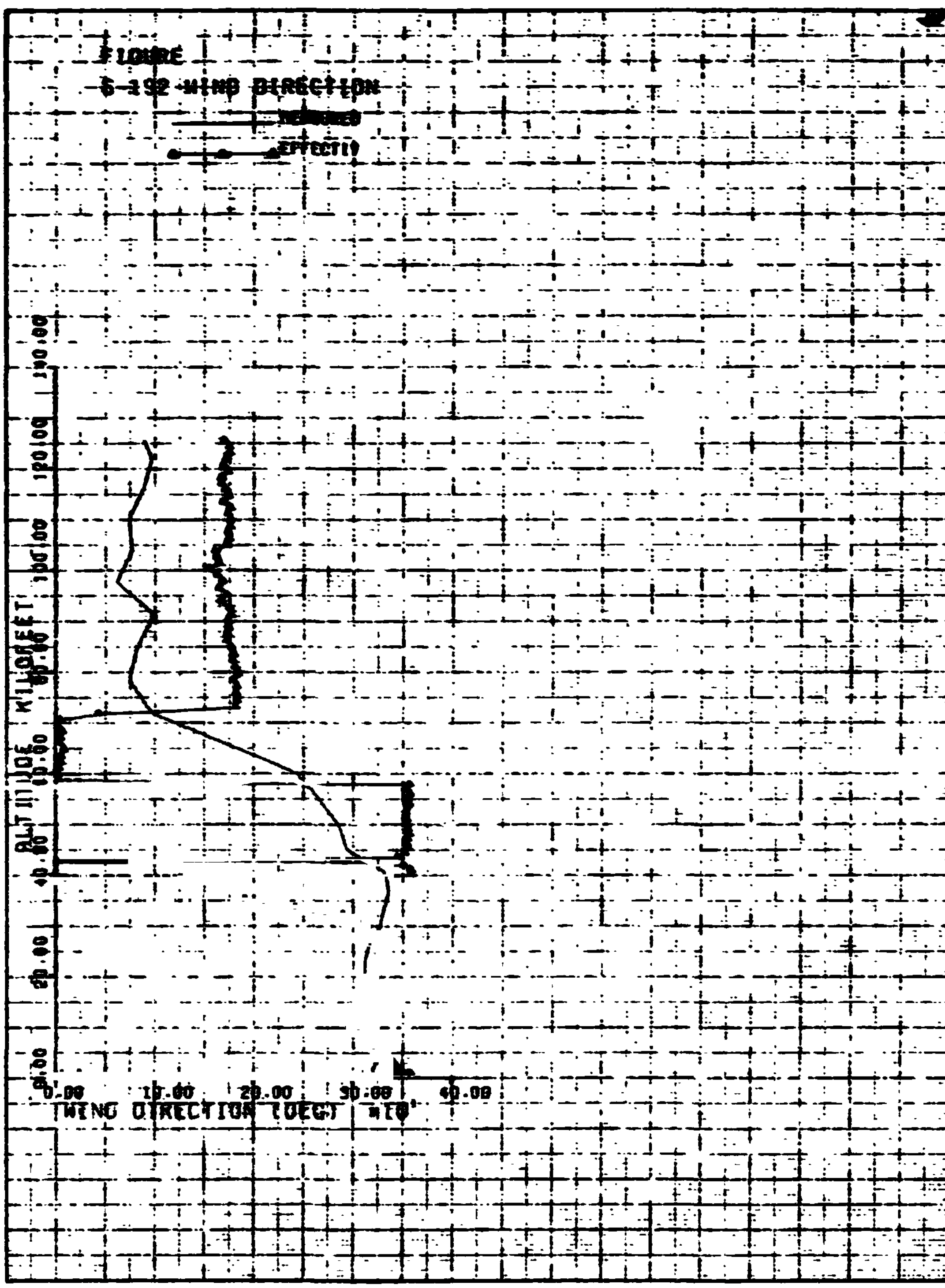

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Figure 12

CP COMP Plot - Yaw Moments

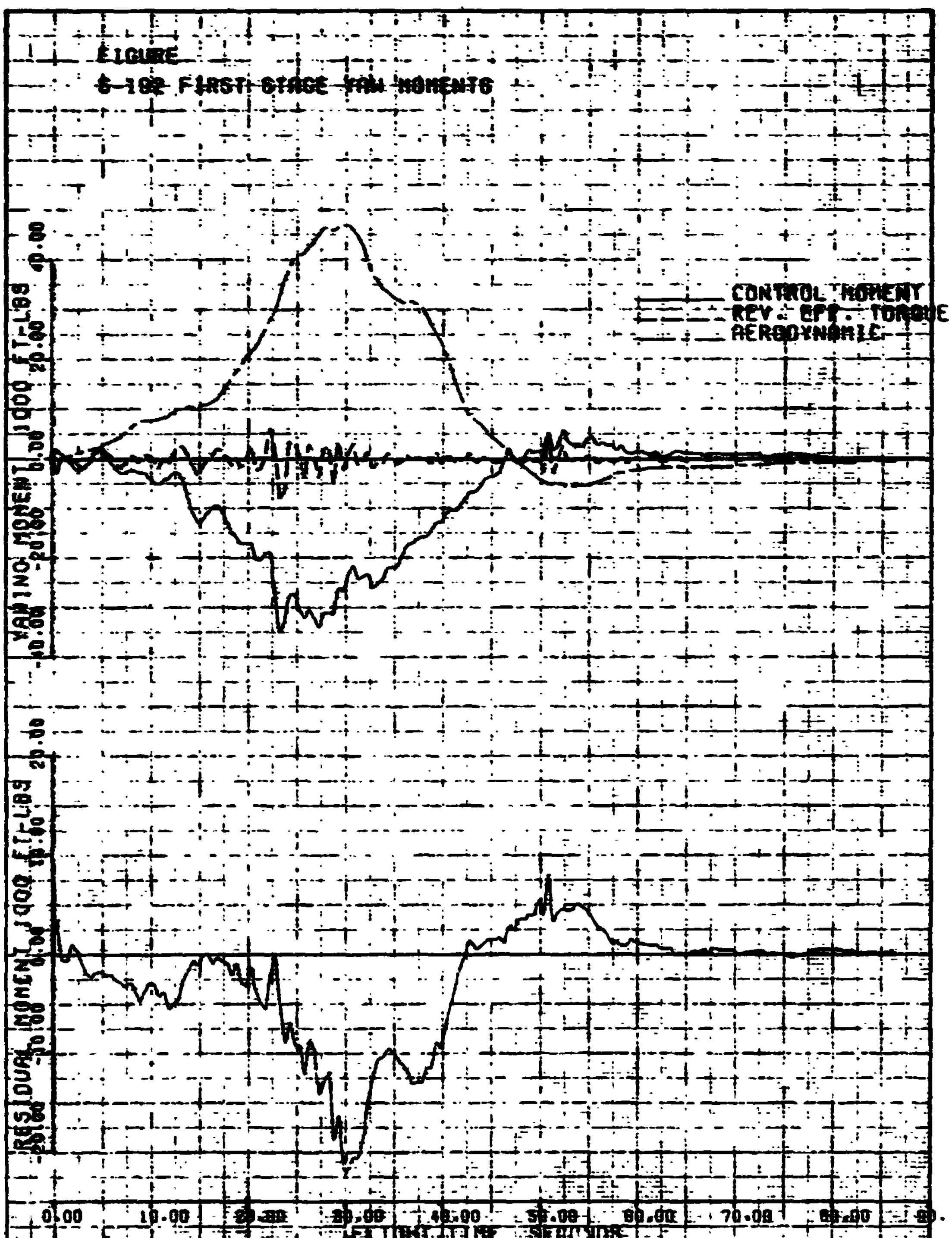

Figure 13

CALCOMP Plot - Roll Moment

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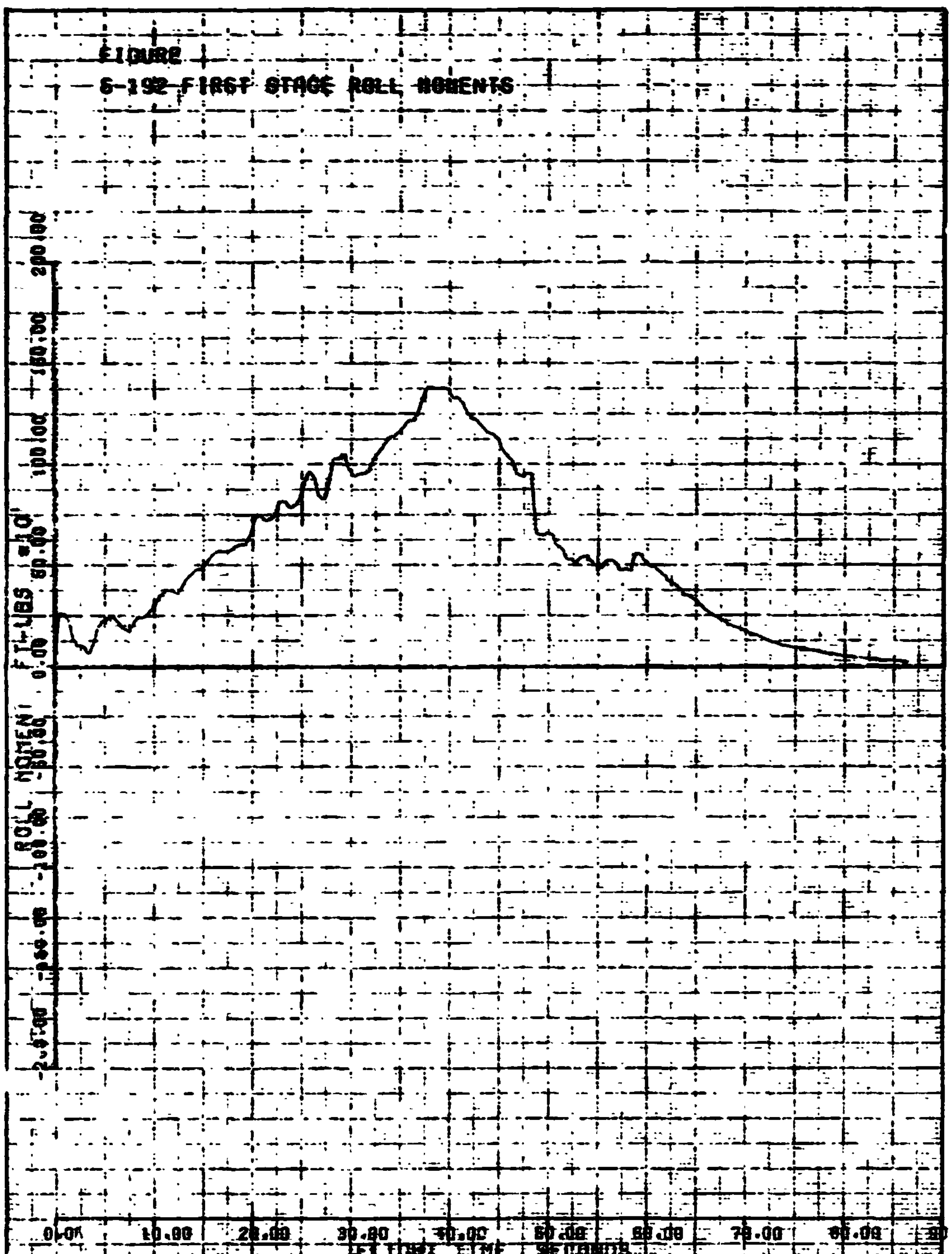

Figure 14

CALCOMP Plot - Dynamic Pressure and Mach Number

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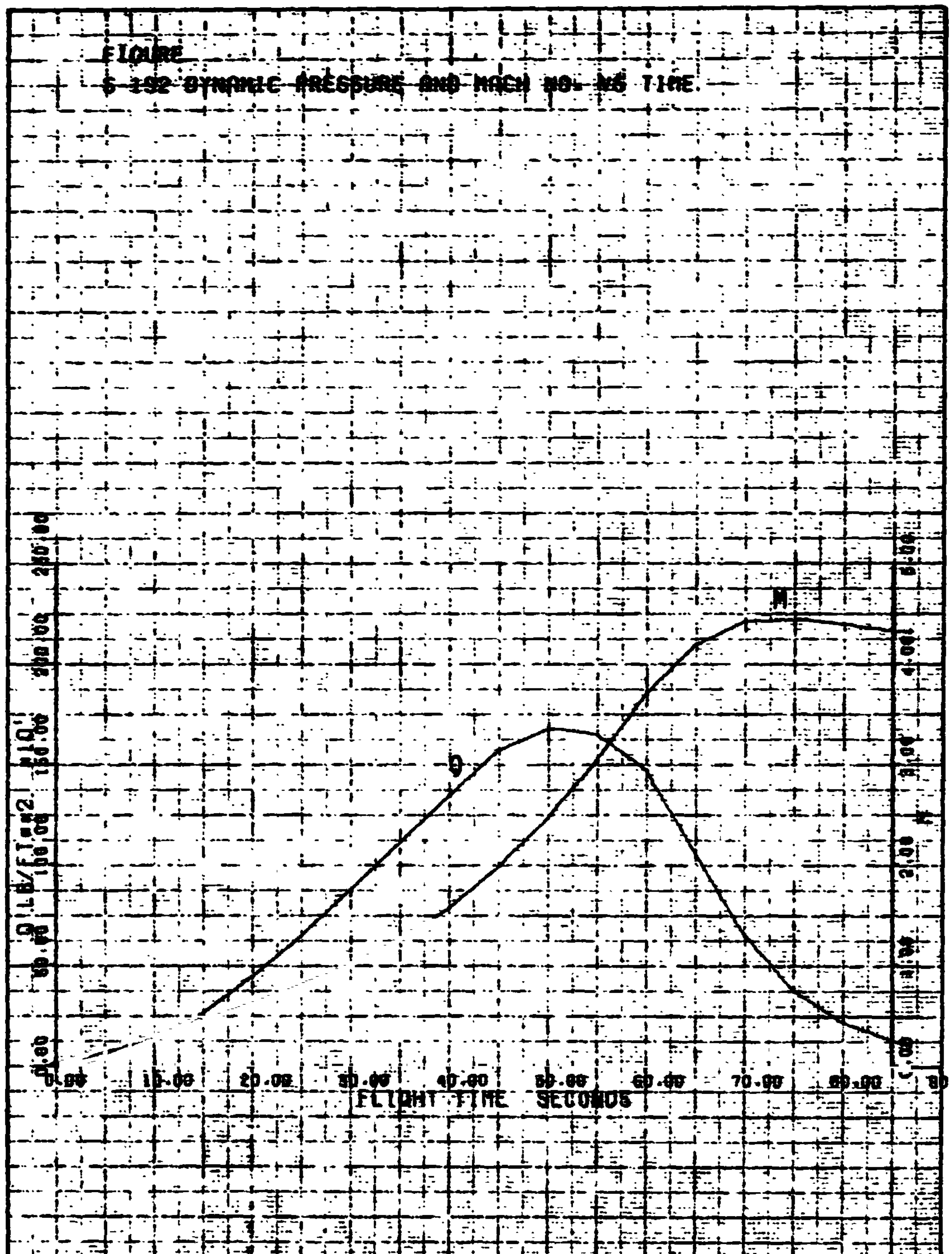

Figure 15
CALCOMP Plot - Control Surface Deflection

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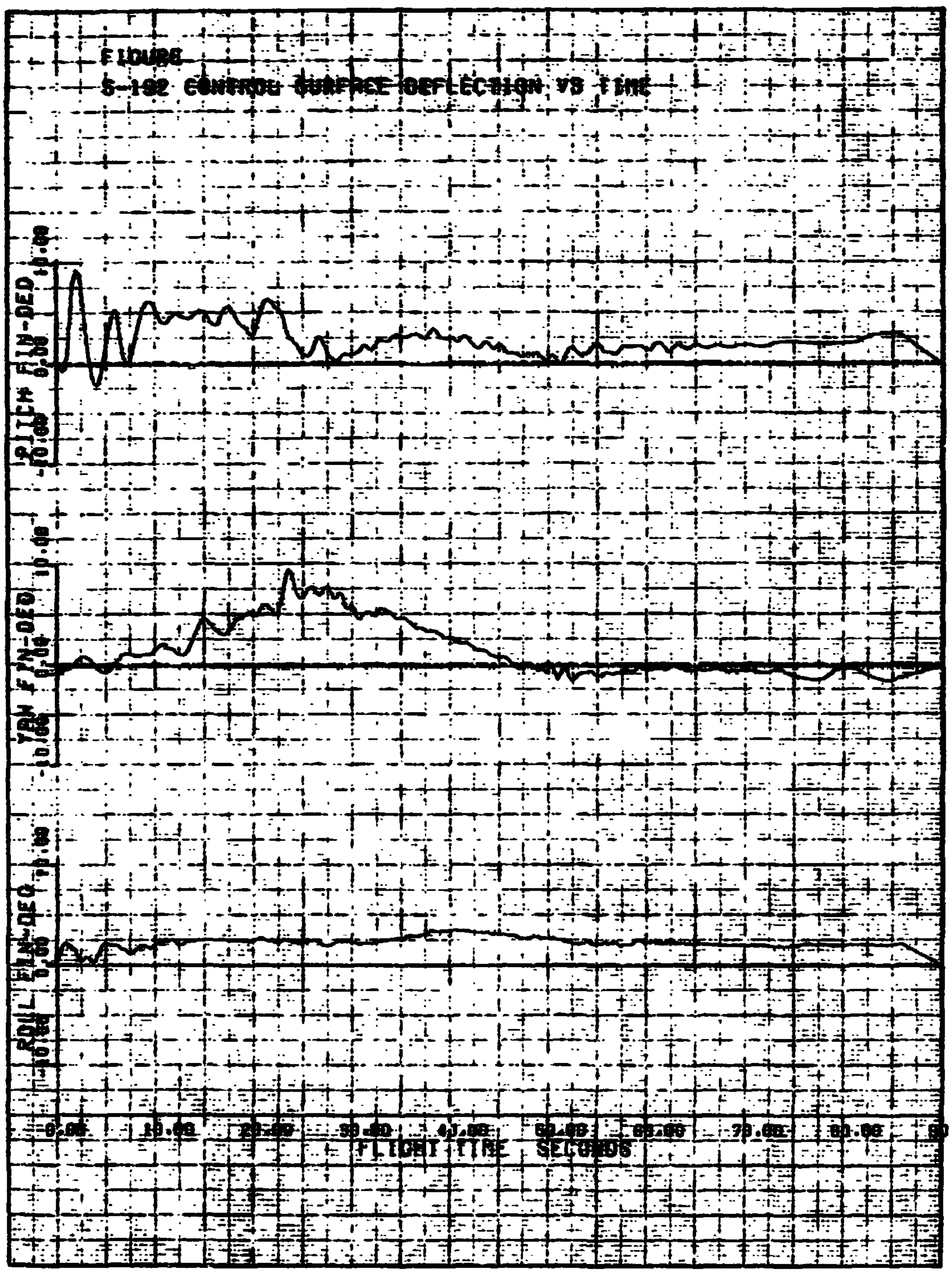

Figure 16

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CALCOMP Plot - Rates

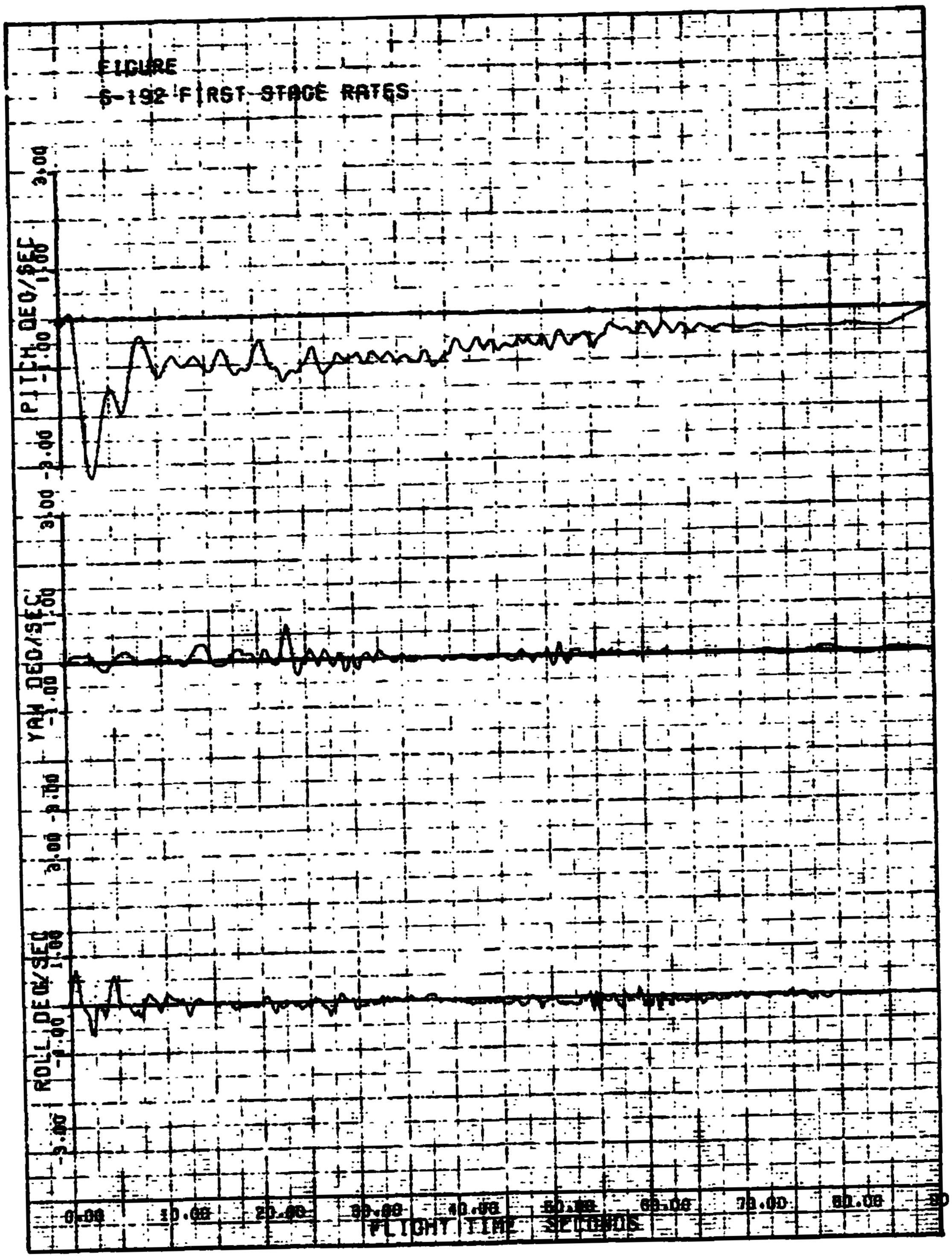


Figure 17

CALCOMP Plot - Angle of Sideslip

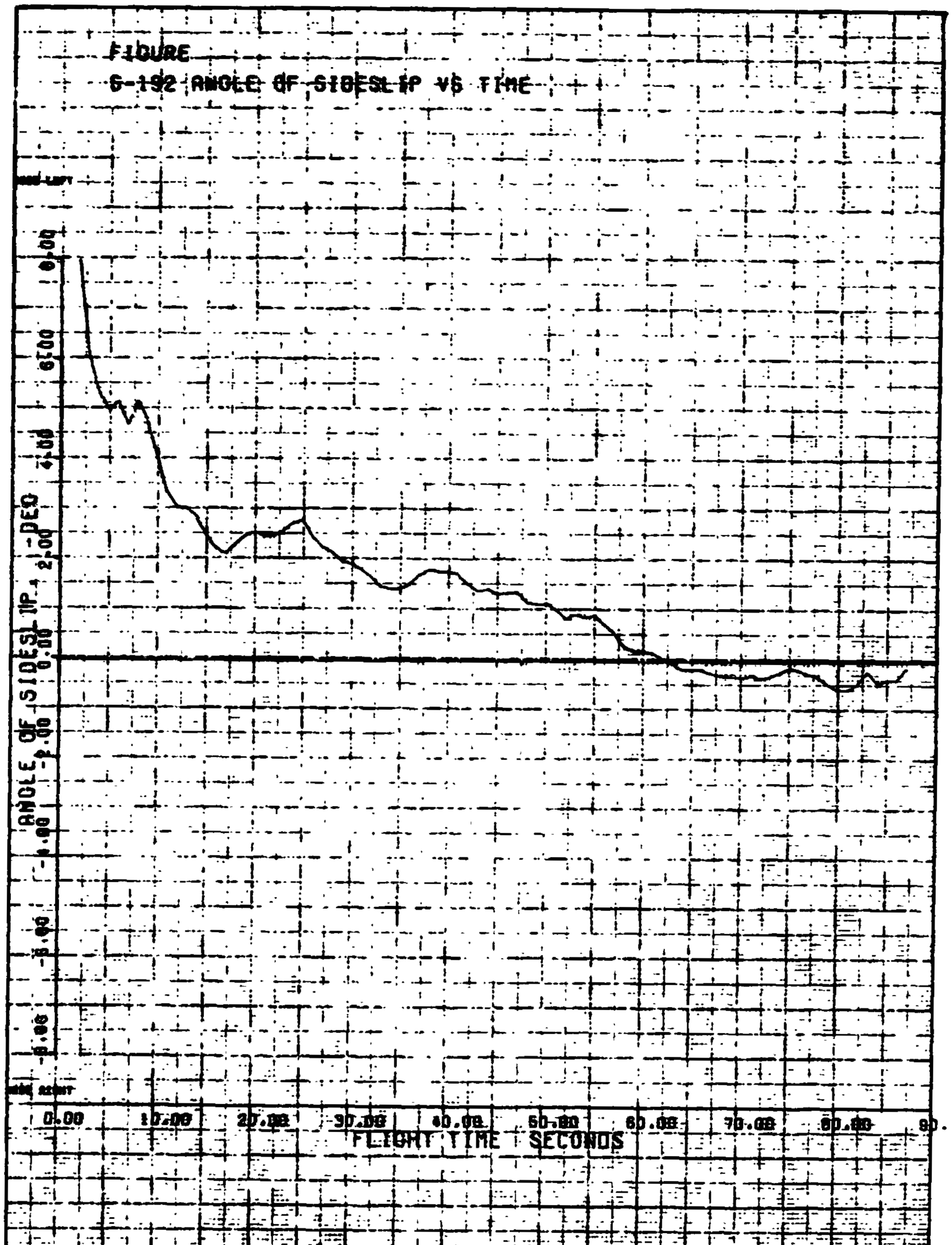
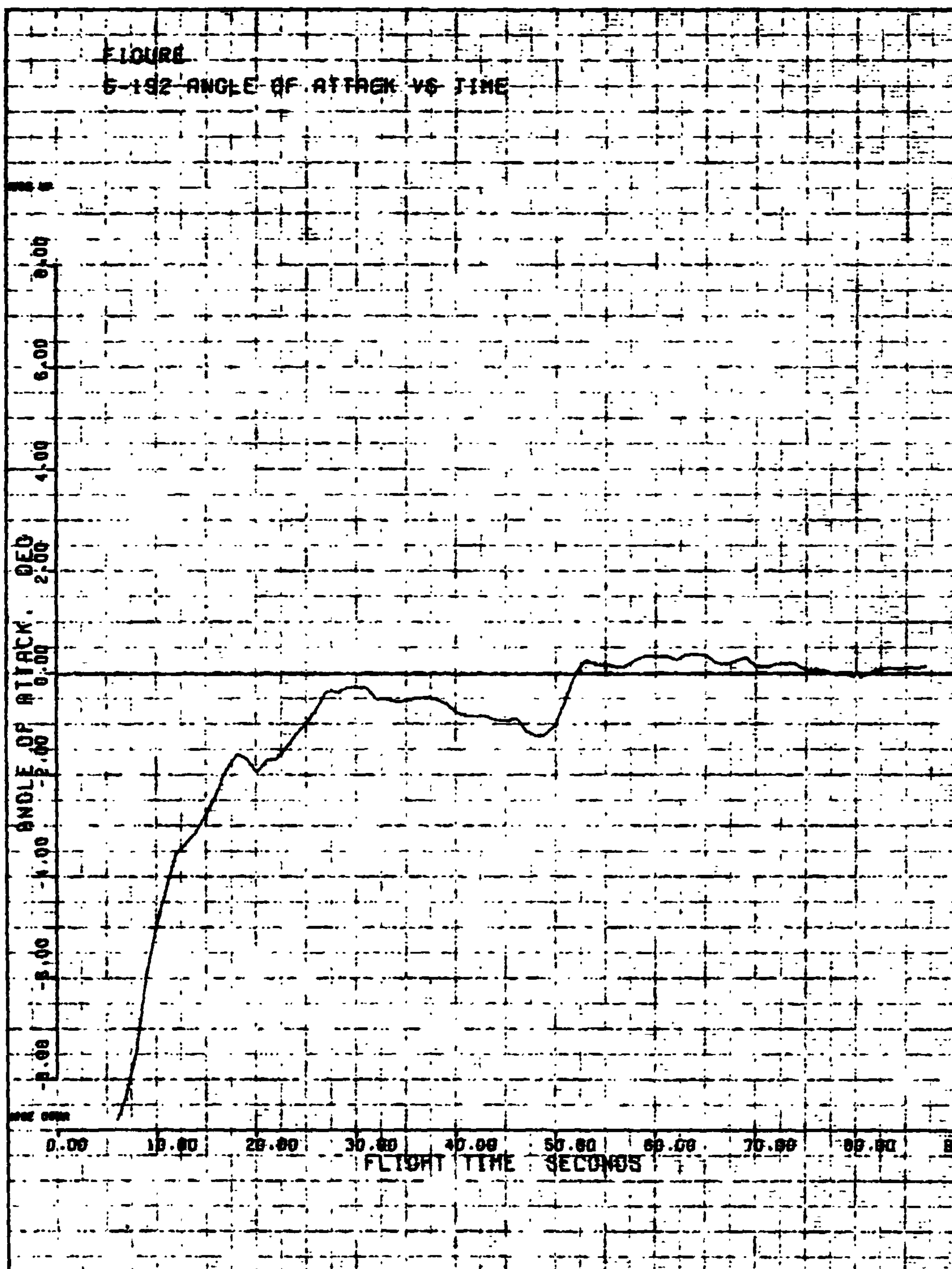


Figure 18

CALCOMP Plot - Angle of Attack



APPENDIX A

FORTRAN PROGRAM LISTING

A complete FORTRAN source program listing is presented in the following pages. It starts with the main routine (STAGE1) and is followed by the twelve (12) subroutines arranged in alphabetical order. There are a total of 755 cards in STAGE1. The total program including subroutines contains 1745 cards.

```
*DECK STAGE1
      PROGRAM STAGE1(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE7)
C     FIRST STAGE MOMENT DISTURBANCE ROUTINE
      DIMENSION XQT(5),XM1T(50),CNAST(5,50),XM2T(50),CMQ1T(5,50),
     1XM3T(50),CMQ2T(5,50),XM4T(50),XCPT(5,50),CNDST(50) ,CLEST(50) ,
     2XCPFNT(50) ,ETFLXT(50) ,DCNST(50) ,DXCPT(50) ,CMOT(50) ,
     3DZCGT(20) ,CNOT(50) ,DYCGT(20) ,CLOT(100),CLERST(50) ,CLPT(50) ,
     4TVACT(100),ALTT(20),PPCT(100),VT(600),TACTT(100),DRAGT(600),
     5XIYYT(20),XCGT(20),ETPT(20),ETYT(20),XIXXT(20),CTIME(20),
     6DTIME(20),NST(42),MXT(4),LXT(4),A(5),C(5),ALT1(600),ZRT(600),
     7VWH(600),ZWH(600),GAMM(600)
      COMMON /PUNSH/PUNCH(6,200),NTITL(6),NNTITL(6),NAME(6)
      COMMON/PLUT/QT(600),XMNT(600),THEDDT(600),THEDT(600),PFINT(600),
     1              ALPHAT(600),PSIDDT(600),PSIDT(600),YFINT(600),
     2              BETAT(600),PHIDDT(600),PHIDT(600),RFINT(600),
     3NT16,NT18,NT24,NT25,NT26,NT27,NT29,NT30,NT31,NT32,NT34,NT35,NT36
     4,IPLOT
      COMMON/P2/ Q,NERR1,NERR2,NRUN,NPAGE,PVAR(180,24),YVAR(180,24),
     1   RVAR(180,9),WIND(180,9),LTIT(8)
      DATA PI/3.1415926535/
      DATA (NTITL(I),I=1,6)/10HTIME      ,10HPITCH MO  ,10HPITCH TH  ,
     1 10HYAW MOME  ,10HYAW THRU  ,10HROLL MOM  /
      DATA (NNTITL(I),I=1,6)/10H          ,10HMENT      ,10HRUST MIS  ,
     1 10HNT        ,10HST MIS    ,10HENT       /
      DATA (NAME(I),I=1,6)/10H TAUM=    ,10H DPITCH=  ,10H DPITCH=  ,
     1 10H DYAW=    ,10H DYAW=    ,10H DROLL=   /
C     READ IN PITCH AND/OR YAW CHANNEL PERMANENT TABLES
C     READ IN PITCH,YAW AND ROLL PERMANENT TABLES
C     READ IN NXQT VALUES OF DYNAMIC PRESSURE FOR DOUBLE TABLES
      READ( 5,830) NXQT,(XQT(I),I=1,NXQT)
C     READ IN NXMIT MACH NUMBER VALUES FOR CNAS TABLE
      READ( 5,830) NXM1T,(XM1T(I),I=1,NXM1T)
C     READ IN  VALUES OF CNAS
      DO 10 I=1,NXQT
```

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```
   10 READ( 5,850) (CNAST(I,J),J=1,NXM1T)
C        READ IN  MACH NUMBER VALUES FOR CMQ1 TABLE
      READ( 5,835) NXM2T,CG1,(XM2T(I),I=1,NXM2T)
C        READ IN  VALUES OF CMQ1
      DO 20 I=1,NXQT
   20 READ( 5,850) (CMQ1T(I,J),J=1,NXM2T)
C        READ IN  MACH NUMBER VALUES FOR CMQ2 TABLE
      READ( 5,835) NXM3T,CG2,(XM3T(I),I=1,NXM3T)
C        READ IN  VALUES OF CMQ2
      DO 30 I=1,NXQT
   30 READ( 5,850) (CMQ2T(I,J),J=1,NXM3T)
C        READ IN  MACH NUMBER VALUES FOR XCP TABLE
      READ( 5,830) NXM4T,(XM4T(I),I=1,NXM4T)
C        READ IN  VALUES OF XCP
      DO 40 I=1,NXQT
   40 READ( 5,850) (XCPT(I,J),J=1,NXM4T)
C        READ IN SINGLE VALUED AERODYNAMIC TABLES OF COEFFICIENTS
      READ( 5,830) NT1,(CNDST(I),I=1,NT1)
      READ( 5,830) NT2,(CLEST(I),I=1,NT2)
      READ( 5,830) NT3,(XCPFNT(I),I=1,NT3)
      READ( 5,830) NT4,(ETFLXT(I),I=1,NT4)
      READ( 5,830) NT5,(DCNST(I),I=1,NT5)
      READ( 5,830) NT6,(DXCPT(I),I=1,NT6)
C        READ IN PITCH CHANNEL PERMANENT TABLES
      READ( 5,830) NT7,(CMOT(I),I=1,NT7)
      READ( 5,830) NT8,(DZCGT(I),I=1,NT8)
C        READ IN YAW   CHANNEL PERMANENT TABLES
      READ( 5,830) NT9,(CNOT(I),I=1,NT9)
      READ( 5,830) NT10,(DYCGT(I),I=1,NT10)
C        READ IN ROLL  CHANNEL PERMANENT TABLES
      READ( 5,830) NT11,(CLOT(I),I=1,NT11)
      READ( 5,830) NT12,(CLERST(I),I=1,NT12)
      READ( 5,830) NT13,(CLPT(I),I=1,NT13)
C        READ IN CONTROL CARD FOR RUN NO, AND CHANNEL OPTION
```

```
   50 READ( 5,840) NRUN,NACC,NAACP,NPUNCH,NPLOT
      READ( 5,870)
C     READ IN PITCH, YAW AND ROLL CHANNEL TEMPORARY TABLES
C     READ IN BOOSTER MOTOR VARIABLES
      READ( 5,830) NT14,(TVACT(I),I=1,NT14)
C     READ IN ACTUAL THRUST VERSUS TIME
      READ( 5,830) NT20,(TACTT(I),I=1,NT20)
C     READ IN WEIGHT OF PROPELLANT REMAINING VS. TIME
      READ( 5,830) NT19,(PPCT(I),I=1,NT19)
C     READ IN PITCH AND YAW PREDICTED RIGID BODY THRUST MISALIGNMENT
      READ( 5,830) NT28,(ETPT(I),I=1,NT28)
      READ( 5,830) NT33,(ETYT(I),I=1,NT33)
C     READ IN JET VANE VARIABLE
      READ( 5,830) NT15,(ALTT(I),I=1,NT15)
C     READ IN JET VANE COEFFI.IENTS
      READ( 5,830) NAT,(A(I),I=1,NAT)
C     READ IN MASS PROPERTIES
      READ( 5,830) NT23,(XCGT(I),I=1,NT23)
      READ( 5,830) NT22,(XIYYT(I),I=1,NT22)
      READ( 5,830) NT37,(XIXXT(I),I=1,NT37)
C     READ IN TRAJECTORY VARIABLES VERSUS TIME
      READ( 5,830) NT16,(QT(I),I=1,NT16)
      READ( 5,830) NT17,(VT(I),I=1,NT17)
      READ( 5,830) NT18,(XMNT(I),I=1,NT18)
      READ( 5,830) NT42,(GAMM(I),I=1,NT42)
      READ( 5,830) NT39,(ZRT(I),I=1,NT39)
      READ( 5,830) NT38,(ALT1(I),I=1,NT38)
C     READ IN WIND VELOCITY AND DIRECTION VERSUS ALTITUDE
      READ( 5,830) NT40,(VWH(I),I=1,NT40)
      READ( 5,830) NT41,(ZWH(I),I=1,NT41)
C     CHANGE WEIGHT VERSUS TIME TABLE TO PERCENT P.C. VERSUS TIME
      WIGN=PPCT(2)
      DO 60 I=2,NT19,2
   60 PPCT(I)=((WIGN-PPCT(I))*100.)/WIGN
```

```
      READ( 5,830) NT21,(DRAGT(I),I=1,NT21)
C     READ IN ANGLE OF ATTACK AND SIDESLIP
      READ( 5,830) NT27,(ALPHAT(I),I=1,NT27)
      READ( 5,830) NT32,(BETAT(I),I=1,NT32)
C     TEST FOR INPUT ACCELERATION(NAACP=0),OR RATE DIFFERENTIATION
C     NAACP=1,USEING LEAST SQUARES POLYNOMIAL CURVE FIT OR RATE.
      IF(NAACP.GT.0) GO TO 80
C     ANGULAR ACCELERATION (OR SLOPES),RATES AND CONTROL DEFLECTIONS
C     READ IN PITCH YAW AND ROLL TELEMETRY DATA
      READ( 5,860) NT24,PKTH,PKTM,(THEDDT(I),I=1,NT24)
C     TEST FOR ACCELERATION OR SLOPE NACC=0 ACCEL, NACC=1 SLOPE
      IF (NACC .LE. 0 ) GO TO 90
      MERP=0
      DO 70 I=1,NT24,2
      CALL ACC (THEDDT(I+1),PKTH,PKTM,MARY)
   70 MERP=MERP+MARY
      IF (MERP .LE. 0 ) GO TO 90
      WRITE( 6,880) MERP
      GO TO 90
C     READ IN NUMBER OF POINTS FOR RATE CURVE FIT, NPCFP AND ORDER
      OF POLYNOMIAL FIT 'NORP'
   80 READ( 5,840) NPCFP,NORP
      READ PITCH RATE DATA
      READ( 5,830) NT25,(THEDT(I),I=1,NT25)
      READ PITCH CONTROL DEFLECTION
       EAD( 5,830) NT26,(PFINT(I),I=1,NT26)
       F(NAACP.GT.0) GO TO 110
C     READ IN YAW ACCELERATION OR SLOPE
      READ( 5,860) NT29,YKTH,YKTM,(PSIDDT(I),I=1,NT29)
      IF (NACC .LE. 0 ) GO TO 120
      MERY=0
      DO 100 I=1,NT29,2
      CALL ACC (PSIDDT(I+1),YKTH,YKTM,KARY)
  100 MERY=MERY+KARY
```

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```
      IF (MERY .LE. 0 ) GO TO 120
      WRITE( 6,890) MERY
      GO TO 120
  110 READ( 5,840) NPCFY,NORY
C     CONTINUE
C     READ IN YAW RATE
  120 READ( 5,830) NT30,(PSIDT(I),I=1,NT30)
C     READ IN YAW DEFLECTION
      READ( 5,830) NT31,(YFINT(I),I=1,NT31)
C     CHANGE BETA TABLE VALUES TO (-) BETA
      DO 130 I=2,NT32,2
  130 BETAT(I)=-BETAT(I)
      IF(NAACP.GT.0) GO TO 150
C     READ IN ROLL ACCELERATION OR SLOPE
      READ( 5,860) NT34,RKTH,RKTM,(PHIDDT(I),I=1,NT34)
      IF (NACC .LE. 0 ) GO TO 160
      MERRO=0
      DO 140 I=1,NT34,2
      CALL ACC (PHIDDT(I+1),RKTH,RKTM,LARY)
  140 MERRO=MERRO+LARY
      IF (MERRO .LE. 0 ) GO TO 160
      WRITE( 6,900) MERRO
      GO TO 160
  150 READ( 5,840) NPCFR,NORR
C     READ IN ROLL RATE
  160 READ( 5,830) NT35,(PHIDT(I),I=1,NT35)
C     READ IN ROLL CONTROL DEFLECTION
      READ( 5,830) NT36,(RFINT(I),I=1,NT36)
C     READ IN ALL CONSTANTS - PITCH,YAW,ROLL
      READ( 5,850) EFINP,EFINY,EFINR,XT,XD,XF,XE,RTIP,RJV,XISP,S,
     1  D,TMMODE,TIME
      READ( 5,830) NTGPS,(CTIME(I),DTIME(I),I=1,NTGPS)
C     INITIALIZE TIME, COUNTERS, ETC.
      NERR1=0
```

```
      NERR2=0
      IK=1
      NPAGE=0
      TIME=-DTIME(IK)+TIME
      NSKIP=1
      NLP=0
C     INITIALIZE ALL TABLE LOOKUP COUNTERS TO THE FIRST VALUE
      DO 170 I=1,42
  170 NST(I)=1
      DO 180 I=1,4
      MXT(I)=1
  180 LXT(I)=1
C     TEST FOR TIME TO CHANGE DELTA TIME
  200 IF (TIME-CTIME(IK) .LT. 0.) GO TO 210
      IK=IK+1
C     TEST FOR END OF RUN
      IF (IK-NTGPS .GT. 0 ) GO TO 645
C     BEGIN CALCULATION WITH A NEW TIME VALUE
  210 TIME=TIME+DTIME(IK)
      NLP=NLP+1
C     COMPUTE TABLE VALUES FOR COMMON PITCH, YAW AND ROLL TABLES
      CALL TBLU (NT14,TVAC,TIME,TVACT,NST(14))
      CALL TBLU (NT15,ALT,TIME,ALTT,NST(15))
      CALL TBLU (NT16,Q,TIME,QT,NST(16))
      IF(Q.EQ.0.) Q=1.E-6
      CALL TBLU (NT17,V,TIME,VT,NST(17))
      IF(V.EQ.0.) V=1.E-6
      CALL TBLU (NT18,XMN,TIME,XMNT,NST(18))
      CALL TBLU (NT1,CNDS,XMN,CNDST,NST(1))
      CALL TBLU (NT19,PPC,TIME,PPCT,NST(1))
      CALL TBLU (NT42,GAM,TIME,GAMM,NST(42))
      CALL TBLU (NT39,ZR,TIME,ZRT,NST(39))
      CALL TBLU (NT38,H,TIME,ALT1,NST(38))
      CALL TBLU (NT40,VW,H,VWH,NST(40))
```

```
      CALL TBLU (NT41,ZW,H,ZWH,NST(41))
      QSD=Q*S*D
C     CALCULATE JET VANE EFFECTIVENESS
      XLDEL=0.
      DO 230 I=1,NAT
      IF (I-1 .GT. 0 ) GO TO 220
      C(I)=A(1)
      GO TO 230
  220 C(I)=A(I)*ALT**(I-1)
  230 XLDEL=TVAC*C(I)+XLDEL
C     CALCULATE AERODYNAMIC FIN EFFECTIVENESS
      CNDSQ=CNDS*Q
C     COMPUTE TABLE VALUES FOR COMMON PITCH AND/OR YAW TABLES
      CALL TBLU (NT20,TACT,TIME,TACTT,NST(20))
      CALL TBLU (NT21,DRAG,TIME,DRAGT,NST(21))
      CALL TBLU (NT22,XIYY,PPC,XIYYT,NST(22))
      CALL TBLU (NT23,XCG,PPC,XCGT,NST(23))
      CALL TBLU (NT2,CLES,XMN,CLEST,NST(2))
      CALL TBLU (NT3,XCPFN,XMN,XCPFNT,NST(3))
      CALL TBLU (NT4,ETFLX,XMN,ETFLXT,NST(4))
      CALL DTBLN (CNAS,Q,XMN,NXQT,XQT,NXM1T,XM1T,CNAST,MXT(1),LXT(1))
      CALL DTBLN (CMQ1,Q,XMN,NXQT,XQT,NXM2T,XM2T,CMQ1T,MXT(2),LXT(2))
      CALL DTBLN (CMQ2,Q,XMN,NXQT,XQT,NXM3T,XM3T,CMQ2T,MXT(3),LXT(3))
      CALL DTBLN (XCP,Q,XMN,NXQT,XQT,NXM4T,XM4T,XCPT,MXT(4),LXT(4))
C     COMPUTE VALUE FOR CMQSD
      CMQSD=CMQ1-(CG1-XCG)*(CMQ1-CMQ2)/(CG1-CG2)
      XLT=(XT-XCG)/12.
      XLF=(XF-XCG)/12.
      XLE=(XE-XCG)/12.
C     COMPUTE REUSEABLE COMBINATIONS FOR PITCH-YAW CHANNEL(S)
      XLCP=(XCG-XCP)/12.
      XLCPFN=(XCG-XCPFN)/12.
      XLD=(XCG-XD)/12.
      AXF=TACT-DRAG
```

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```
      XMT=TACT*(XT-XCG)/12.
C     TEST DIVISORS FOR ZERO TO PREVENT OVERFLOW
      IF (V.NE. 0.) GO TO 240
      CMQSDQ=0.0
      GO TO 250
  240 CMQSDQ=CMQSD*Q/V
  250 IF ((XLT-XLF).NE. 0.) GO TO 260
      XLJD=2.*XLE**2-XLT**2
      GO TO 270
  260 XLJD=(XLT**2*(2.*XLT-3.*XLF)+XLF*XLF*XLF)/(3.*(XLT-XLF))+2.*XLE**2
     1-XLT**2
  270 XNJDC=-TVAC*XLJD/(32.2*57.3*XISP)
C     BEGIN PITCH CHANNEL CALCULATIONS
C     COMPUTE TABLE VALUES FOR REMAINING PITCH VARIABLES
C     TEST NAACP FOR DIFFERENTIATION OF RATE DATA; 1=YES, 0=NO
      IF (NAACP .LE. 0 ) GO TO 280
C     CALL DIFFERENTIATION SUBROUTINE SMDF
      CALL SMDF (NT25,THEDT,TIME,NPCFP,NORP,THEDD)
      GO TO 290
C     TABLE LOOKUP PITCH ACCELERATION
  280 CALL TBLU (NT24,THEDD,TIME,THEDDT,NST(24))
  290 CALL TBLU (NT25,THED,TIME,THEDT,NST(25))
      CALL TBLU (NT26,PFIN,TIME,PFINT,NST(26))
      CALL TBLU (NT27,ALPHA,TIME,ALPHAT,NST(27))
      CALL TBLU (NT28,ETP,TIME,ETPT,NST(28))
      CALL TBLU (NT7,CMO,XMN,CMOT,NST(7))
      CALL TBLU (NT8,DZCG,PPC,DZCGT,NST(8))
      CALL TBLU (NT32,BETA,TIME,BETAT,NST(32))
C     COMPUTE TOTAL AERO ANGLE AND NON-LINEAR COEFFICIENTS
      ETA=0.
      CNS=0.
      CNSY=0.
      TANA=TAN(ALPHA/57.3)
      TANB=TAN(BETA/57.3)
```

```
      T2B=TANA*TANA+TANB*TANB
      IF(T2B.EQ.0.) GO TO 292
      TETA=SQRT(T2B)
      ETA=57.3*ATAN(TETA)
      COSP=TANA/TETA
      SINP=TANB/TETA
  292 CALL TBLU (NT5,DCNS,ETA,DCNST,NST(5))
      CALL TBLU (NT6,DXCP,ETA,DXCPT,NST(6))
      CNSAB=CNAS*ETA+DCNS
      CNS=CNSAB*COSP
      CNSY=CNSAB*SINP
      CNASA=CNAS*ALPHA
      CNASB=CNAS*BETA
      XLCPA=(XCG-XCP-DXCP)/12.
      CNSQ=CNS*Q
      XMA=CNSQ*XLCPA
      XMO=CMO*QSD
      XMEFN=CLES*XLCPFN*EFINP*Q
      XMD=CMQSDQ*THED
      XMAERO=XMA+XMO+XMEFN+XMD
      XMETP=XMT*ETP/57.3
      XMCG=AXF*DZCG/12.
C     COMPUTE CONTROL FORCE AND MOMENT IN PITCH
      FCONT=2.*PFIN*(XLDEL+CNDSQ)
      XMCNTL=FCONT*XLD
C      COMPUTE THRUST MISALIGNMENT DUE TO FLEXIBILITY
      ETPFLX=(ETFLX*Q*ALPHA+FCONT*TMMODE)
      XMETFX=XMT*ETPFLX
C     COMPUTE JET DAMPING MOMENT IN PITCH
      XMJD=XNJDC*THED
C     COMPUTE INERTIA MOMENT
      XMI=XIYY*THEDD/57.3
C     COMPUTE RESIDUAL PITCHING MOMENT
      DELM=XMI-XMAERO-XMCNTL-XMCG-XMETP-XMJD-XMETFX
```

```
C     COMPUTE EFFECTIVE ANGLE OF ATTACK TO ELIMINATE RESIDUAL
      AKA=(CNAS*XLCPA+ETFLX*XMT)*Q
      DELA=1.E+6
      IF(AKA.EQ.0.) GO TO 295
      DELA=DELM/AKA
  295 GAM=GAM/57.3
C     COMPUTE EFFECTIVE PITCH COMPONENT OF WIND
      ADUM=DELA*COS(GAM)-57.3*SIN(GAM)
      DVWP=0.
      IF(ADUM.EQ.0.) GO TO 296
      DVWP=-V*DELA/(DELA*COS(GAM)-57.3*SIN(GAM))
  296 CMPRED=CNS*XLCPA/(D*S)+CMO
      IF (QSD.NE. 0.) GO TO 300
      CMEFF=0.0
      GO TO 310
C     COMPUTE EFFECTIVE AERODYNAMIC CENTER AND MOMENT COEFFICIENT
  300 CMEFF=CMPRED+DELM/QSD
  310 XCPPRP=XCP+DXCP
      IF (CNSQ.NE. 0.) GO TO 320
      XCPEFP=0.0
      GO TO 330
  320 XCPEFP=XCPPRP-12.*DELM/CNSQ
  330 IF (XMT.NE. 0.) GO TO 340
C     COMPUTE EFFECTIVE PITCH THRUST MISALIGNMENT
      ETEFFP=57.3*ETPFLX+ETP
      GO TO 350
  340 ETEFFP=57.3*(DELM/XMT+ETPFLX)+ETP
  350 IF (XLD*PFIN.NE. 0.) GO TO 360
      XLDEFP=XLDEL
      GO TO 370
C     COMPURE EFFECTIVE JET VANE PERFORMANCE
  360 XLDEFP=XLDEL+DELM/(XLD*2.*PFIN)
  370 XMPRMP=DELM+XMJD+XMCG+XMEFN
      ETPRIG=ETEFFP-ETPFLX*57.3
```

```
      IF (XMT.NE. 0.) GO TO 380
      ETPPRM=ETPRIG
      GO TO 390
  380 ETPPRM=ETPRIG+57.3*(XMEFN+XMCG+XMJD)/XMT
C     STORE OUTPUT OF PITCH VARIABLES IN PVAR ARRAY
  390 PVAR(NLP,1)=TIME
      PVAR(NLP,2)=DELM
      PVAR(NLP,3)=XMAERO
      PVAR(NLP,4)=XMCNTL
      PVAR(NLP,5)=XMI
      PVAR(NLP,6)=XMJD
      PVAR(NLP,7)=XMCG
      PVAR(NLP,8)=XMETFX
      PVAR(NLP,9)=XMPRMP
      PVAR(NLP,10)=ETPFLX*57.3
      PVAR(NLP,11)=ETPRIG
      PVAR(NLP,12)=ETPPRM
      PVAR(NLP,13)=XLCPA
      PVAR(NLP,14)=XMA
      PVAR(NLP,15)=XMO
      PVAR(NLP,16)=XMEFN
      PVAR(NLP,17)=XMD
      PVAR(NLP,18)=CMPRED
      PVAR(NLP,19)=CMEFF
      PVAR(NLP,20)=XCPPRP
      PVAR(NLP,21)=XCPEFP
      PVAR(NLP,22)=ETEFFP
      PVAR(NLP,23)=XLDEFP
      PVAR(NLP,24)=XLDEL
C     BEGIN YAW CHANNEL CALCULATIONS
C     COMPUTE TABLE VALUES FOR REMAINING YAW VARIABLES
      IF (NAACP .LE. 0 ) GO TO 400
C     DIFFERENTIATE YAW RATE TO GET ACCELERATION
      CALL SMDF (NT30,PSIDT,TIME,NPCFY,NORY,PSIDD)
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```
      GO TO 410
C     TABLE LOOKUP OF YAW ACCELERATION
  400 CALL TBLU (NT29,PSIDD,TIME,PSIDDT,NST(29))
  410 CALL TBLU (NT30,PSID,TIME,PSIDT,NST(30))
      CALL TBLU (NT31,YFIN,TIME,YFINT,NST(31))
      CALL TBLU (NT33,ETY,TIME,ETYT,NST(33))
      CALL TBLU (NT9,CNO,XMN,CNOT,NST(9))
      CALL TBLU (NT10,DYCG,PPC,DYCGT,NST(10))
C     COMPUTE REUSEABLE COMBINATIONS FOR YAW CHANNEL
      CNSQ=CNSY*Q
      XNA=CNSQ*XLCPA
      XNO=CNO*S*D*Q
      XNEFN=CLES*XLCPFN*EFINY*Q
      XND=CMQSDQ*PSID
      XNAERO=XNA+XNO+XNEFN+XND
      XNETY=XMT*ETY/57.3
      FCONT=2.*YFIN*(XLDEL+CNDSQ)
      XNCNTL=FCONT*X'5
      XNCG=AXF*DYCG/12.
      ETYFLX=(ETFLX*Q*BETA+FCONT*TMMODE)
      XNETFX=XMT*ETYFLX
      XNJD=XNJDC*PSID
      XNI=XIYY*PSIDD/57.3
C     COMPUTE RESIDUAL YAWING MOMENT
      DELN=XNI-XNAERO-XNCNTL-XNCG-XNETY-XNJD-XNETFX
C     BEGIN TO COMPUTE EFFECTIVE PARAMETERS IN YAW
      AKA=(CNAS*XLCPA+ETFLX*XMT)*Q
      DELB=0.
      IF(AKA.EQ.0.) GO TO 415
      DELB=-DELN/AKA
  415 DVWY=V*DELB/57.3
      CNPRED=CNSY*XLCPA/(D*S)+CNO
      IF (QSD.NE. 0.) GO TO 420
      CNEFF=CNPRED
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      GO TO 430
  420 CNEFF=CNPRED+DELN/QSD
  430 XCPPRY=XCP+DXCP
      IF (CNSQ.NE. 0.) GO TO 440
      XCPEFY=XCPPRY
      GO TO 450
  440 XCPEFY=XCPPRY-12.*DELN/CNSQ
  450 IF (XMT.NE. 0.) GO TO 460
      ETEFFY=57.3*ETYFLX+ETY
      GO TO 470
  460 ETEFFY=57.3*(DELN/XMT+ETYFLX)+ETY
  470 IF (XLD*YFIN.NE. 0.) GO TO 480
      XLDEFY=XLDEL
      GO TO 490
  480 XLDEFY=XLDEL+DELN/(XLD*2.*YFIN)
  490 XNPRMY=DELN+XNJD+XNCG+XNEFN
      ETYRIG=ETEFFY-ETYFLX*57.3
      IF (XMT.NE. 0.) GO TO 500
      ETYPRM=ETYRIG
      GO TO 510
  500 ETYPRM=ETYRIG+57.3*(XNEFN+XNCG+XNJD)/XMT
  510 ETEFFT=SQRT(ETEFFP*ETEFFP+ETEFFY*ETEFFY)
C     STORE ALL YAW OUTPUT VARIABLES IN YVAR ARRAY
      YVAR(NLP,1)=TIME
      YVAR(NLP,2)=DELN
      YVAR(NLP,3)=XNAERO
      YVAR(NLP,4)=XNCNTL
      YVAR(NLP,5)=XNI
      YVAR(NLP,6)=XNJD
      YVAR(NLP,7)=XNCG
      YVAR(NLP,8)=XNETFX
      YVAR(NLP,9)=XNPRMY
      YVAR(NLP,10)=ETYFLX*57.3
      YVAR(NLP,11)=ETYRIG
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      YVAR(NLP,12)=ETYPRM
      YVAR(NLP,13)=ETEFFT
      YVAR(NLP,14)=XNA
      YVAR(NLP,15)=XNO
      YVAR(NLP,16)=XNEFN
      YVAR(NLP,17)=XND
      YVAR(NLP,18)=CNPRED
      YVAR(NLP,19)=CNEFF
      YVAR(NLP,20)=XCPPRY
      YVAR(NLP,21)=XCPEFY
      YVAR(NLP,22)=ETEFFY
      YVAR(NLP,23)=XLDEFY
      YVAR(NLP,24)=XLDEL
C   THIS SECTION COMPUTES THE EFFECTIVE WIND VELOCITY AND DIRECTION
C   VERSUS ALTITUDE
C   CALCULATE COMPONENTS OF WIND VELOCITY
      ANGL=(ZR-ZW)/57.3
      VP=VW*COS(ANGL)
      VY=-VW*SIN(ANGL)
      VWPP=VP+DVWP
      VWYP=VY+DVWY
C   CALCULATE AND LOCATE NEW VELOCITY VECTOR
      IF (VWPP .NE. 0.) GO TO 550
      IF (VWYP) 520,530,540
  520 XL=1.5*PI
      GO TO 560
  530 XLW=0.0
      VWP=0.0
      GO TO 580
  540 XL=0.5*PI
      GO TO 560
  550 XL=ATAN(VWYP/VWPP)
      IF (VWPP .GE. 0.) GO TO 560
      XL=XL+PI
```

```
  560 XLW=57.3*XL+ZR
      VWP=SQRT(VWPP*VWPP+VWYP*VWYP)
      IF (XLW .GE. 0.) GO TO 570
      XLW=XLW+360.
      GO TO 580
  570 IF (XLW-360. .LE. 0.) GO TO 580
      XLW=XLW-360.
  580 CONTINUE
      DV=VW-VWP
C     STORE EFFECTIVE ANGLE OF ATTACK AND WIND IN WIND ARRAY
      WIND(NLP,1)=TIME
      WIND(NLP,2)=H
      WIND(NLP,3)=VW
      WIND(NLP,4)=VWP
      WIND(NLP,5)=DV
      WIND(NLP,6)=ZW
      WIND(NLP,7)=XLW
      WIND(NLP,8)=DELF
      WIND(NLP,9)=DELB
C     BEGIN ROLL CHANNEL CALCULATIONS
C     COMPUTE TABLE VALUES FOR REMAINING ROLL VARIABLES
      IF (NAACP .LE. 0 ) GO TO 590
C     DIFFERENTIATE ROLL RATE TO OBTAIN ACCELERATION
      CALL SMDF (NT35,PHIDT,TIME,NPCFR,NORR,PHIDD)
      GO TO 600
C     TABLE LOOKUP OF ROLL ACCELERATION
  590 CALL TBLU (NT34,PHIDD,TIME,PHIDDT,NST(34))
  600 CALL TBLU (NT35,PHID,TIME,PHIDT,NST(35))
      CALL TBLU (NT36,RFIN,TIME,RFINT,NST(36))
      CALL TBLU (NT37,XIXX,PPC,XIXXT,NST(37))
      CALL TBLU (NT11,CLO,XMN,CLOT,NST(11))
      CALL TBLU (NT12,CLERS,XMN,CLERST,NST(12))
      CALL TBLU (NT13,CLP,XMN,CLPT,NST(13))
C     COMPUTE ROLL INERTIA MOMENT
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      XLI=XIXX*PHIDD/57.3
      CLOSD=CLO*S*D
      IF (V.NE. 0.) GO TO 610
C     COMPUTE STATIC ROLL AERODYNAMIC MOMENT
      XLAERO=Q*(CLOSD+CLERS*EFINR)
      XLAERP=0.0
      GO TO 620
C     COMPUTE TOTAL PREDICTABLE AERODYNAMIC ROLL MOMENT
  610 XLAERO=Q*(CLOSD+CLP*PHID/(2.*V)+CLERS*EFINR)
      XLAERP=CLP*Q*PHID/(2.*V)
C     COMPUTE ROLL CONTROL MOMENT
  620 XLCNTL=-2.*(CNDSQ*RTIP+XLDEL*RJV)*RFIN
C     COMPUTE RESIDUAL ROLLING MOMENT
      DELL=XLI-XLAERO-XLCNTL
      DELLP=XLI-XLAERP-XLCNTL
      IF (QSD.NE. 0.) GO TO 630
C     COMPUTE EFFECTIVE ROLLING MOMENT COEFFICIENT
      CLEFF=0.0
      CLEFFP=0.0
      GO TO 640
  630 CLEFF=DELL/QSD
      CLEFFP=DELLP/QSD
C     STORE ROLL OUTPUT VARIABLES IN RVAR ARRAY
  640 RVAR(NLP,1)=TIME
      RVAR(NLP,2)=DELL
      RVAR(NLP,3)=XLAERO
      RVAR(NLP,4)=XLCNTL
      RVAR(NLP,5)=XLI
      RVAR(NLP,6)=CLEFF
      RVAR(NLP,7)=XLAERP
      RVAR(NLP,8)=CLEFFP
      RVAR(NLP,9)=DELLP
C     RETURN TO COMPUTATION FOR NEXT TIME POINT
      GO TO 200
```

```
C     END OF COMPUTATION LOOP
C     BEGIN THE OUTPUT LOGIC
C     PRINT THE PITCH CHANNEL PARAMETERS
C     TEST FOR MORE THAN 50 LINES OF OUTPUT
  645 IF (NLP-50 .GT. 0 ) GO TO 650
      NP1=1
      NP2=NLP
      NSKIP=1
      GO TO 660
  650 NP1=1
      NP2=50
C     PRINT FIRST PAGE OF PITCH PARAMETERS
  660 NPAGE=NPAGE+1
      CALL PAGEHD
      WRITE( 6,870)
      WRITE( 6,910)
      WRITE( 6,920) ((PVAR(I,J),J=1,13),I=NP1,NP2)
C     PRINT SECOND PAGE OF PITCH PARAMETERS
      NPAGE=NPAGE+1
      CALL PAGEHD
      WRITE( 6,870)
      WRITE( 6,930)
      WRITE( 6,940) (PVAR(I,1),(PVAR(I,J),J=14,24),I=NP1,NP2)
C     TEST FOR MORE THAN 50 LINES OF OUTPUT
      IF (NSKIP-2 .EQ. 0 ) GO TO 670
      IF (NLP-50 .LE. 0 ) GO TO 670
      NP1=NP1+50
      NP2=NP2+50
      IF(NP2.GE.NLP)NP2=NLP
      IF(NP2.GE.NLP)NSKIP=2
      GO TO 660
  670 CONTINUE
C     TEST FOR MORE THAN 50 LINES OF OUTPUT
      IF (NLP-50 .GT. 0 ) GO TO 680
```

```
      NP1=1
      NP2=NLP
      NSKIP=1
      GO TO 690
  680 NP1=1
      NP2=50
      NSKIP=1
C     PRINT FIRST PAGE OF YAW PARAMETERS
  690 NPAGE=NPAGE+1
      CALL PAGEHD
      WRITE( 6,870)
      WRITE( 6,950)
      WRITE( 6,920) ((YVAR(I,J),J=1,13),I=NP1,NP2)
C     PRINT SECOND PAGE OF YAW PARAMETERS
      NPAGE=NPAGE+1
      CALL PAGEHD
      WRITE( 6,870)
      WRITE( 6,960)
      WRITE( 6,940) (YVAR(I,1),(YVAR(I,J),J=14,24),I=NP1,NP2)
C     TEST FOR MORE THAN 50 LINES OF OUTPUT
      IF (NSKIP-2 .EQ. 0 ) GO TO 700
      IF (NLP-50 .LE. 0 ) GO TO 700
      NP1=NP1+50
      NP2=NP2+50
      IF(NP2.GE.NLP)NP2=NLP
      IF(NP2.GE.NLP)NSKIP=2
      GO TO 690
  700 CONTINUE
C TEST FOR MORE THAN 50 LINES OF OUTPUT
      IF (NLP-50 .GT. 0 ) GO TO 710
      NP1=1
      NP2=NLP
      NSKIP=1
      GO TO 720
```

```
  710 NP1=1
      NP2=50
      NSKIP=1
C PRINT PAGE OF EFFECTIVE WIND PARAMETERS
  720 NPAGE=NPAGE+1
      CALL PAGEHD
      WRITE( 6,870)
      WRITE( 6,970)
      WRITE( 6,980)
      WRITE( 6,990) ((WIND(I,J),J=1,9),I=NP1,NP2)
C TEST FOR MORE THAN 50 LINES OF OUTPUT
      IF (NSKIP-2 .EQ. 0 ) GO TO 730
      IF (NLP-50 .LE. 0 ) GO TO 730
      NP1=NP1+50
      NP2=NP2+50
      IF(NP2.GE.NLP)NP2=NLP
      IF(NP2.GE.NLP)NSKIP=2
      GO TO 720
  730 CONTINUE
C     TEST FOR MORE THAN 50 LINES OF OUTPUT
      IF (NLP-50 .GT. 0 ) GO TO 740
      NP1=1
      NP2=NLP
      NSKIP=1
      GO TO 750
  740 NP1=1
      NP2=50
      NSKIP=1
C     PRINT PAGE OF ROLL PARAMETERS
  750 NPAGE=NPAGE+1
      CALL PAGEHD
      WRITE( 6,870)
      WRITE( 6,1000)
      WRITE( 6,1010) ((RVAR(I,J),J=1,9),I=NP1,NP2)
```

```
C     TEST FOR MORE THAN 50 LINES OF OUTPUT
      IF (NSKIP-2 .EQ. 0 ) GO TO 760
      IF (NLP-50 .LE. 0 ) GO TO 760
      NP1=NP1+50
      NP2=NP2+50
      IF(NP2.GE.NLP)NP2=NLP
      IF(NP2.GE.NLP)NSKIP=2
      GO TO 750
  760 CONTINUE
C     TEST FOR PUNCH CARD OUTPUT OF RESIDUAL MOMENTS AND THRUST MISALIGN
      IF (NPUNCH .LE. 0 ) GO TO 820
      DO 770 I=1,6
  770 PUNCH(I,1)=0.0
      DO 780 I=1,NLP
      PUNCH(1,I+1)=PVAR(I,1)
      PUNCH(2,I+1)=PVAR(I,9)
      PUNCH(3,I+1)=PVAR(I,12)
      PUNCH(4,I+1)=YVAR(I,9)
      PUNCH(5,I+1)=YVAR(I,12)
  780 PUNCH(6,I+1)=RVAR(I,9)
      NLP=NLP+1
      DO 800 I=2,NLP
      IF (ABS(PUNCH(3,I))-20.0 .LE. 0.) GO TO 790
      PUNCH(3,I)=0.0
  790 IF (ABS(PUNCH(5,I))-20.0 .LE. 0.) GO TO 800
      PUNCH(5,I)=0.0
  800 CONTINUE
      DO 810 J=1,6
  810 CALL PUNAID (J,NLP)
  820 CONTINUE
C     TEST FOR CALCOMP PLOTS OF RESULTS; IF NPLOT IS BLANK=NO PLOT
      IF (NPLOT.EQ.0) STOP
C     CALCOMP PLOT. READ IN 80 COLUMNS OF TITLE FOR TOP OF PLOT
      READ( 5,1020) (LTIT(J),J=1,8)
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C     READ IN PLOT VARIABLE OPTION 'NOPT' AND 5 CHARACTER  VEHICLES NO.
      READ(5,845) NOPT,IPLOT
C     CALL PLOT SUBROUTINE. VARIABLES ARE TRANSFERRED IN COMMON'PLOT'
C     AND 'P2'. NOPT=1 PITCH VARIABLES ONLY
C               NOPT=2  YAW ONLY
C               NOPT=3 ROLL VARIABLES ONLY
C               NOPT=4 PITCH AND YAW VARIABLES ONLY
C               NOPT=5 PITCH,YAW,AND ROLL VARIABLES PLOTTED
C                      AS WELL AS SELECTED INPUT VARIABLES
      CALL CURVE (NOPT,NLP)
C     RETURN TO BEGINNING FOR NEXT PROBLEM
      STOP
C     THE FOLLOWING ARE THE INPUT AND OUTPUT FORMAT STATEMENTS
  830 FORMAT (I10/(8E10.3))
  835 FORMAT(I10,E10.3/(8E10.3))
  840 FORMAT (7I10)
  845 FORMAT(I10,5X,A5)
  850 FORMAT (8E10.3)
  860 FORMAT(I10,2E10.3,/(8E10.3))
  870 FORMAT (72H
     1                 /72H
     2                            /72H
     3                                       )
  880 FORMAT(5X,68HENTERED A SLOPE GREATER THAN 90.0 DEGREES IN THE PITC
     1H SLOPE TABLE.   /5X,9HTHERE ARE ,I5,
     239H SLOPES GREATER THAN 90.0 IN THE TABLE.  /5X,
     331HTHE VALUE HAS BEEN SET TO ZERO.   )
  890 FORMAT(5X,66HENTERED A SLOPE GREATER THAN 90.0 DEGREES IN THE YAW
     1SLOPE TABLE.   /5X,9HTHERE ARE ,I5,
     239H SLOPES GREATER THAN 90.0 IN THE TABLE.  /5X,
     331HTHE VALUE HAS BEEN SET TO ZERO.    )
  900 FORMAT(5X,67HENTERED A SLOPE GREATER THAN 90.0 DEGREES IN THE ROLL
     1 SLOPE TABLE.  /5X,9HTHERE ARE ,I5,
     239H SLOPES GREATER THAN 90.0 IN THE TABLE.  /5X,
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     331HTHE VALUE HAS BEEN SET TO ZERO.    )
 910 FORMAT (1H ,46HFIRST STAGE MOMENT DISTURBANCE - PITCH CHANNEL/129H
     1   TIME     DELTA-M   M(AERO)  M(CONTRL)    M(I)      M(JD)   M(CG)
     2   M(ETFLX)  M(PRIME)   ET(FLX)  ET(RIGID) ET(PRIME) (XCG-XCP) /12
     39H  (SEC)    (FT-LB)   (FT-LB)   (FT-LB)   (FT-LB)    (FT-LB) (FT-
     4LB)   (FT-LB)   (FT-LB)    (DEG)     (DEG)     (DEG)      (FT)   /
     5/)
 920 FORMAT (1H ,F7.2,8F10.0,4F10.3)
 930 FORMAT (1H ,58HFIRST STAGE MOMENT DISTURBANCE - PITCH CHANNEL (CON
     1TINUED)/119H   TIME   M(ALPHA)     M(O)    M(EFIN)   M(DAMP)   CM(
     2PRED)  CM(EFF)  XCP(PRED)P XCP(EFF)P ET(EFF)P  LD(EFF)P  LD(PRED)/
     3119H  (SEC)    (FT-LB)   (FT-LB)   (FT-LB)   (FT-LB)
     4           (IN)        (IN)      (DEG)    (LB/DEG)  (LB/DEG))
 940 FORMAT (1H ,F7.2,4F10.0,2F10.4,2F10.2,3F10.3)
 950 FORMAT (1H ,44HFIRST STAGE MOMENT DISTURBANCE - YAW CHANNEL/129H
     1 TIME     DELTA-N   N(AERO)  N(CONTRL)    N(I)      N(JD)   N(CG)
     2 N(ETFLX)  N(PRIME)   ET(FLX)  ET(RIGID) ET(PRIME)  ETEFF(T) /129H
     3  (SEC)    (FT-LB)   (FT-LB)   (FT-LB)   (FT-LB)    (FT-LB) (FT-LB
     4)   (FT-LB)   (FT-LB)    (DEG)     (DEG)     (DEG)      (DEG)  //)
 960 FORMAT (1H ,58HFIRST STAGE MOMENT DISTURBANCE - YAW CHANNEL (CONTI
     1NUED)  /119H   TIME   N(ALPHA)     N(O)    N(EFIN)   N(DAMP)   CN(
     2PRED)  CN(EFF)  XCP(PRED)Y XCP(EFF)Y ET(EFF)Y  LD(EFF)Y  LD(PRED)/
     3119H  (SEC)    (FT-LB)   (FT-LB)   (FT-LB)   (FT-LB)
     4           (IN)        (IN)      (DEG)    (LB/DEG)  (LB/DEG))
 970 FORMAT(1H0,6X,45HNOTE... THE FOLLOWING  EFFECTIVE  OR DELTA    ,
     135HPARAMETERS ARE CALCULATED ASSUMING  ,/,10X,
     245HTHE DELTA (RESIDUAL) MOMENTS ARE DUE TO WINDS  ,/)
C     FORMATS FOR WIND AND ROLL OUTPUT
 980 FORMAT(1H0,6X,44HTIME   ALTITUDE    WIND   EFFECTIVE    DELTA  ,
     140H     WIND   EFFECTIVE    DELTA     DELTA ,/,23X,8HVELOCITY ,
     255H  WIND VEL  WIND VEL DIRECTION  WIND DIR    ALPHA       ,
     34HBETA,/6X,45H(SEC)  (KILOFEET)(FT/SEC)  (FT/SEC)  (FT/SEC)  ,
     439H    (DEG)     (DEG)     (DEG)     (DEG)  ,/)
 990 FORMAT (1H ,9F10.2)
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1000 FORMAT (1H0,45HFIRST STAGE MOMENT DISTURBANCE - ROLL CHANNEL//89H
    1  TIME     DELTA-L   L(AERO)   L(CONTRL)   L(I)    CL(EFF)   L(AERO
    2P)  CL(EFFP)  DELTA-LP//89H  (SEC)     (FT-LB)   (FT-LB)    (FT-LB)
    3  (FT-LB)               (FT-LB)              (FT-LB) )
1010 FORMAT (1H ,F7.2,4F10.0,F10.4,F13.0,F10.4,F10.0)
1020 FORMAT (8A10)
     END
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*DECK ACC
      SUBROUTINE ACC (ANSWER,XKR,XKT,MKT)
C     THIS SUBROUTINE COMPUTES THE ANGULAR ACCELERATION FROM A
C     SLOPE OF A RATE TRACE (IN DEGREES) GIVEN THE SCALE FACTOR
C     XKR IN DEG/SEC PER UNIT LENGTH OF TRACE, AND THE TRACE
C     PAPER SPEED 'XKT' IN UNIT LENGTH PER SECOND.
C     THE INPUT SLOPE AND THE OUTPUT ACCELERATION IS TRANSFERRED
C     VIA ANSWER.
      IF (ABS(ANSWER)-90. .GE. 0.) GO TO 10
      A=ANSWER/57.3
      MKT=0
      ANSWER=XKR*XKT*SIN(A)/COS(A)
      GO TO 20
   10 ANSWER=0.
      MKT=1
   20 RETURN
      END
```

```
*DECK CURVE
      SUBROUTINE CURVE (NOPT,NLP)
C     THIS SUBROUTINE SETS UP THE PARTICULAR VARIABLES AND OPTION TO
C     PLOT A SERIES OF CALCOMP PLOTS.  'NLP IS THE NUMBER OF ABSCISSA
C     POINTS FOR EACH OF THE CURVES PLOTTED.
C     NOTE THAT CALCOMP PLOTTING COMMANDS AND SETUP MAY BE HIGHLY
C     MACHINE DEPENDENT. CONSULT YOUR COMPUTER DEPARTMENT!!!
      INTEGER TIME(2),P1(3),P2(3),P3(4),P4(4),P5(4),Y2(3),R1(2),WD(2),
     1 AL(2),DIR(2)
      DIMENSION VWH(300),ZWH(300)
      COMMON/PLUT/QT(600),XMNT(600),THEDDT(600),THEDT(600),PFINT(600),
     1            ALPHAT(600),PSIDDT(600),PSIDT(600),YFINT(600),
     2            BETAT(600),PHIDDT(600),PHIDT(600),RFINT(600),
     3NT16,NT18,NT24,NT25,NT26,NT27,NT29,NT30,NT31,NT32,NT34,NT35,NT36
     4,IPLOT
      COMMON/P2/ Q,NERR1,NERR2,NRUN,NPAGE,PVAR(180,24),YVAR(180,24),
     1   RVAR(180,9),WIND(180,9),LTIT(8)
      DATA Z1,Z2,Z3,SPA,TS,ETS,ETLIM,XLIM,YLIM/0.42,0.07,0.14,0.,10.,.2,
     13.0,9.0,6.0/
      DATA TIME(1),TIME(2)/10HFLIGHT TIM ,10HE  SECONDS/
      DATA (P1(I),I=1,3)/10HRESIDUAL M ,10HOMENT 1000,10H FT-LBS    /
      DATA (P2(I),I=1,3)/10HPITCHING M ,10HOMENT  100,10H0 FT-LBS   /
      DATA (P3(I),I=1,4`/10HEFFECTIVE  ,10HPITCH MISA ,10HLIGNMENT   ,
     1 10H(DEGREES) /
      DATA (P4(I),I=1,4)/10HEFFECTIVE ,10HYAW MISALI,10HGNMENT  (D ,
     1 10HEGREES)   /
      DATA (P5(I),I=1,4)/10HEFFECTIVE ,10HTOTAL MISA,10HLIGNMENT  ,
     1 10H(DEGREES)  /
      DATA (Y2(I),I=1,3)/10HYAWING MOM ,10HENT  1000 ,10HFT-LBS    /
      DATA (R1(I),I=1,2)/10HROLL MOMEN ,10HT  FT-LBS  /
      DATA WD(1),WD(2)/10HWIND VELOC ,10HITY  KNOTS /
      DATA AL(1),AL(2)/10HALTITUDE   ,10HKILOFEET   /
      DATA DIR(1),DIR(2)/10HWIND DIREC ,10HTION (DEG)  /
      IF (IFIRST.NE.0) GO TO 10
C     CALL FACTOR NECESSARY TO PLOT ON CENTIMETER GRID PAPER
```

```
      CALL FACTOR (2.0/2.54)
      IFIRST=1
   10 CONTINUE
      LSYMB=2
      N=NLP
      NP=0
      NR=0
      NY=0
C TEST OPTION
      IF (NOPT-1 .GT. 0 ) GO TO 20
      NP=1
      GO TO 70
   20 IF (NOPT-3) 30,40,50
   30 NY=1
      GO TO 210
   40 NR=1
      GO TO 280
   50 IF (NOPT-5 .GE. 0 ) GO TO 60
      NP=1
      NY=1
      GO TO 70
   60 NP=1
      NY=1
      NR=1
C  START PITCH
   70 CALL PLOTS (5HCAL26,0,4HPLOT)
      CALL PLOT (.5,4.0,-3)
      CALL PLOT (9.0,0.0,2)
      CALL SYMBOL (-2.,0.,.07,LTIT,90.,80)
      CALL AXIS (0.0,-2.5,TIME,-20,9.0,0.0,0.0,TS)
      DO 80 J=1,N
      VWH(J)=PVAR(J,1)
   80 ZWH(J)=PVAR(J,2)/1000.
      Y=MAXA(N,ZWH)
      YS=10.
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      YSM=-20.
      IF (Y-25. .LE. 0.) GO TO 90
      YS=20.
      YSM=-40.
   90 CONTINUE
      CALL AXIS (0.,-2.,P1,28,4.,90.,YSM,YS)
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,YS,LSYMB,XLIM,2.5)
C NEXT PLOT CONTROL,AERO,INERTIA MOMENTS
      CALL PLOT (0.,5.,-3)
      CALL SYMBOL (0.5,3.0,0.14,6HFIGURE,0.0,6)
      CALL SYMBOL (0.5,2.7,0.14,IPLOT,0.0,5)
      CALL SYMBOL (1.2,2.7,0.14,29H FIRST STAGE PITCHING MOMENTS,0.0,29)
      CALL PLOT(6.,1.6,3)
      CALL PLOT(6.9,1.6,2)
      CALL SYMBOL (7.,1.6,0.14,14HCONTROL MOMENT,0.0,14)
      CALL PLOT(6.,1.4,3)
      CALL PLOT(6.2,1.4,2)
      CALL PLOT(6.27,1.4,3)
      CALL PLOT(6.47,1.4,2)
      CALL PLOT(6.54,1.4,3)
      CALL PLOT(6.74,1.4,2)
      CALL PLOT(6.81,1.4,3)
      CALL PLOT(6.9,1.4,2)
      CALL SYMBOL (7.,1.4,0.14,16HREV. EFF. TORQUE,0.0,16)
      CALL PLOT(6.0,1.2,3)
      CALL PLOT(6.4,1.2,2)
      CALL PLOT(6.47,1.2,3)
      CALL PLOT(6.54,1.2,2)
      CALL PLOT(6.61,1.2,3)
      CALL PLOT(6.90,1.2,2)
      CALL SYMBOL (7.,1.2,0.14,11HAERODYNAMIC,0.0,11)
      DO 100J=1,N
  100 ZWH(J)=PVAR(J,4)/1000.
      IF (YS-10. .GT. 0.) GO TO 110
      Y=MAXA(N,ZWH)
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      IF (Y-30. .LE. 0.) GO TO 110
      YS=20.
      YSM=-40.
  110 CONTINUE
      CALL PLOT (0.0,0.0,3)
      CALL PLOT (9.0,0.0,2)
      CALL AXIS (0.,-2.,P2,28,4.,90.,YSM,YS)
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,YS,LSYMB,XLIM,3.0)
      DO 120 J=1,N
  120 ZWH(J)=PVAR(J,3)/1000.
      CALL DASH (VWH,ZWH,N,Z1,Z2,Z2,TS,YS,LSYMB,XLIM,3.0)
      DO 130 J=1,N
  130 ZWH(J)=PVAR(J,5)/1000.
      CALL DASH (VWH,ZWH,N,Z3,SPA,Z2,TS,YS,LSYMB,XLIM,3.0)
      X=12.0*2.54/2.0-0.5
      CALL PLOT (X,-9.0,-3)
C GO TO NEXT FRAME
      CALL PLOT (0.0,0.0,995)
      IF (NY-1 .LT. 0 ) GO TO 280
C PLOT THRUST MISALIGNMENT
      CALL PLOTS (5HCAL26,0,4HPLOT)
      CALL PLOT (.5,2.0,-3)
      CALL AXIS (0.0,0.0,TIME,-20,9.0,0.0,0.0,TS)
      CALL AXIS (0.,0.,13HTOTAL DEGREES,13,2.,90.,0.,0.4)
      DO 140 J=1,N
  140 ZWH(J)=YVAR(J,13)
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,0.4,LSYMB,XLIM,3.0)
      CALL PLOT (0.,4.,-3)
      CALL PLOT (0.0,0.0,3)
      CALL PLOT (9.0,0.0,2)
      CALL AXIS (0.,-1.,11HYAW DEGREES,11,2.,90.,-.4,0.4)
      DO 150 J=1,N
  150 ZWH(J)=YVAR(J,22)
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,0.4,LSYMB,XLIM,2.0)
      CALL PLOT (0.,3.,-3)
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      CALL PLOT (0.0,0.0,3)
      CALL PLOT (9.0,0.0,2)
      CALL AXIS (0.,-1.,13HPITCH DEGREES,13,2.,90.,-.4,0.4)
      CALL SYMBOL (0.5,3.0,0.14,6HFIGURE,0.0,6)
      CALL SYMBOL (0.5,2.7,0.14,IPLOT,0.0,5)
      CALL SYMBOL (1.2,2.7,0.14,42H FIRST STAGE EFFECTIVE THRUST MISALIG
     1NMENT,0.0,42)
      DO 160 J=1,N
  160 ZWH(J)=PVAR(J,22)
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,0.4,LSYMB,XLIM,2.0)
      CALL PLOT (X,-9.0,-3)
C GO TO NEXT FRAME
      CALL PLOT (0.0,0.0,999)
C PLOT WIND DATA
      CALL PLOTS (5HCAL26,0,4HPLOT)
      CALL PLOT (.5,2.0,-3)
      CALL SYMBOL (0.5,10.,0.14,6HFIGURE,0.0,6)
      CALL SYMBOL (0.5,9.7,0.14,IPLOT,0.0,5)
      CALL SYMBOL (1.2,9.7,0.14,14H WIND VELOCITY,0.0,14)
      CALL PLOT(1.2,9.4,3)
      CALL PLOT(2.2,9.4,2)
      CALL SYMBOL(2.3,9.4,0.10,8HMEASURED,0.0,8)
      CALL SYMBOL(2.3,9.1,0.10,9HEFFECTIVE,0.0,9)
      CALL SYMBOL(1.2,9.1,0.10,2,0.  ,-1)
      CALL SYMBOL(1.7,9.1,0.10,2,0.  ,-2)
      CALL SYMBOL(2.2,9.1,0.10,2,0.  ,-2)
      CALL AXIS (0.,0.,WD,-20,6.,0.0,0.,40.)
      CALL AXIS (0.,0.,AL,18,7.,90.0,0.,20.)
      DO 170 J=1,N
      ZWH(J)=WIND(J,3)/1.688
  170 VWH(J)=WIND(J,2)
      CALL DASH (ZWH,VWH,N,Z1,Z2,SPA,40.,20.,LSYMB,6.,8.)
      DO 180 J=1,N
  180 ZWH(J)=WIND(J,4)/1.688
      CALL DASH (ZWH,VWH,N,Z3,SPA,-1.0,40.0,20.0,LSYMB,6.0,8.0)
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      CALL PLOT (X,-2.0,-3)
      CALL PLOT (0.0,0.0,999)
      CALL PLOTS (5HCAL26,0,4HPLOT)
      CALL PLOT (.5,2.0,-3)
      CALL SYMBOL (0.5,10.,0.14,6HFIGURE,0.0,6)
      CALL SYMBOL (0.5,9.7,0.14,IPLOT,0.0,5)
      CALL SYMBOL (1.2,9.7,0.14,15H WIND DIRECTION,0.0,15)
      CALL PLOT(1.2,9.4,3)
      CALL PLOT(2.2,9.4,2)
      CALL SYMBOL(2.3,9.4,0.10,8HMEASURED,0.0,8)
      CALL SYMBOL(2.3,9.1,0.10,9HEFFECTIVE,0.0,8)
      CALL SYMBOL(1.2,9.1,0.10,2,0. ,-1)
      CALL SYMBOL(1.7,9.1,0.10,2,0. ,-2)
      CALL SYMBOL(2.2,9.1,0.10,2,0. ,-2)
      CALL AXIS (0.0,0.0,DIR,-20,4.0,0.0,0.0,100.)
      CALL AXIS (0.,0.,AL,18,7.,90.0,0.,20.)
      DO 190 J=1,N
  190 ZWH(J)=WIND(J,6)
      CALL DASH (ZWH,VWH,N,Z1,Z2,SPA,100.,20.,LSYMB,4.,8.)
      DO 200 J=1,N
  200 ZWH(J)=WIND(J,7)
      CALL DASH (ZWH,VWH,N,Z3,SPA,-1.0,100.0,20.0,LSYMB,4.0,8.0)
C GO TO NEXT FRAME
      CALL PLOT (X,-2.0,-3)
      CALL FLOT (0.0,0.0,999)
C YAW OPTION
  210 IF (NY-1 .LT. 0 ) GO TO 280
      CALL PLOTS (5HCAL26,0,4HPLOT)
      CALL PLOT (.5,3.0,-3)
      CALL PLOT (9.0,0.0,2)
      DO 220 J=1,N
      VWH(J)=YVAR(J,1)
  220 ZWH(J)=YVAR(J,2)/1000.
      Y=MAXA(N,ZWH)
      YS=10.
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```
      YSM=-20.
      IF (Y-25. .LE. 0.) GO TO 230
      YS=20.
      YSM=-40.
  230 CALL AXIS (0.,-2.,P1,28,4.,90.,YSM,YS)
      CALL AXIS (0.0,-2.5,TIME,-20,9.0,0.0,0.0,TS)
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,YS,LSYMB,XLIM,2.5)
      CALL PLOT (0.,5.,-3)
      CALL PLOT (9.0,0.0,2)
      DO 240 J=1,N
  240 ZWH(J)=YVAR(J,4)/1000.
      IF (YS-10. .GT. 0.) GO TO 250
      Y=MAXA(N,ZWH)
      IF (Y-30. .LE. 0.) GO TO 250
      YS=20.
      YSM=-40.
  250 CALL AXIS (0.,-2.,Y2,26,4.,90.,YSM,YS)
      CALL SYMBOL (0.5,4.0,0.14,6HFIGURE,0.0,6)
      CALL SYMBOL (0.5,3.7,0.14,IPLOT,0.0,5)
      CALL SYMBOL (1.2,3.7,0.14,24H FIRST STAGE YAW MOMENTS,0.0,24)
      CALL PLOT(6.,1.6,3)
      CALL PLOT(6.9,1.6,2)
      CALL SYMBOL (7.,1.6,0.14,14HCONTROL MOMENT,0.0,14)
      CALL PLOT(6.,1.4,3)
      CALL PLOT(6.2,1.4,2)
      CALL PLOT(6.27,1.4,3)
      CALL PLOT(6.47,1.4,2)
      CALL PLOT(6.54,1.4,3)
      CALL PLOT(6.74,1.4,2)
      CALL PLOT(6.81,1.4,3)
      CALL PLOT(6.9,1.4,2)
      CALL SYMBOL (7.,1.4,0.14,16HREV. EFF. TORQUE,0.0,16)
      CALL PLOT(6.,1.2,3)
      CALL PLOT(6.4,1.2,2)
      CALL PLOT(6.47,1.2,3)
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      CALL PLOT(6.54,1.2,2)
      CALL PLOT(6.61,1.2,3)
      CALL PLOT(6.90,1.2,2)
      CALL SYMBOL (7.,1.2,0.14,11HAERODYNAMIC,0.0,11)
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,YS,LSYMB,XLIM,3.0)
      DO 260 J=1,N
  260 ZWH(J)=YVAR(J,3)/1000.
      CALL DASH (VWH,ZWH,N,Z1,Z2,Z2,TS,YS,LSYMB,XLIM,3.0)
      DO 270 J=1,N
  270 ZWH(J)=YVAR(J,5)/1000.
      CALL DASH (VWH,ZWH,N,Z3,SPA,Z2,TS,YS,LSYMB,XLIM,3.0)
      CALL PLOT (X,-8.0,-3)
C GO TO NEXT FRAME
      CALL PLOT (0.0,0.0,999)
  280 IF (NR-1 .LT. 0 ) GO TO 430
C  PLOT ROLL MOMENTS
      CALL PLOTS (5HCAL26,0,4HPLOT)
      CALL PLOT (.5,6.0,-3)
      CALL PLOT (9.0,0.0,2)
      CALL AXIS (0.0,-5.5,TIME,-20,9.0,0.0,0.0,TS)
      CALL AXIS (0.,-4.,R1,19,8.,90.,-2000.,500.)
      CALL SYMBOL (0.5,6.0,0.14,6HFIGURE,0.0,6)
      CALL SYMBOL (0.5,5.7,0.14,IPLOT,0.0,5)
      CALL SYMBOL (1.2,5.7,0.14,25H FIRST STAGE ROLL MOMENTS,0.0,25)
      DO 290 J=1,N
      VWH(J)=RVAR(J,1)
  290 ZWH(J)=RVAR(J,9)
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,500.,LSYMB,XLIM,5.)
      CALL PLOT (X,-6.0,-3)
      CALL PLOT (0.0,0.0,999)
      IF (NOPT.NE.5) RETURN
C  PLOT Q AND M VS TIME
      CALL PLOTS (5HCAL26,0,4HPLOT)
      CALL PLOT (.5,2.0,-3)
      CALL AXIS (0.0,0.0,TIME,-20,9.0,0.0,0.0,TS)
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      CALL AXIS (0.0,0.0,10HQ LB/FT**2,10,5.0,90.0,0.0,500.0)
      CALL AXIS (8.5,0.0,1HM,-1,5.0,90.0,0.0,1.0)
      I=1
      DO 300J=1,NT16,2
      VWH(I)=QT(J)
      ZWH(I)=QT(J+1)
      I=I+1
  300 CONTINUE
      N=NT16/2
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,500.,LSYMB,XLIM,7.0)
      I=1
      DO 310 J=1,NT18,2
      VWH(I)=XMNT(J)
      ZWH(I)=XMNT(J+1)
      I=I+1
  310 CONTINUE
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,1.0,LSYMB,XLIM,7.0)
      CALL SYMBOL (0.5,10.,0.14,6HFIGURE,0.0,6)
      CALL SYMBOL (0.5,9.7,0.14,IPLOT,0.0,5)
      CALL SYMBOL (1.2,9.7,0.14,38H DYNAMIC PRESSURE AND MACH NO. VS TIM
     1E,0.0,38)
      CALL PLOT (X,-2.0,-3)
      CALL PLOT (0.0,0.0,999)
C  PLOT FINS VS TIME
      CALL PLOTS (SHCAL26,0,4HPLOT)
      CALL PLOT (.5,3.0,-3)
      CALL PLOT (9.,0.,2)
      CALL AXIS (0.0,-1.5,TIME,-20,9.0,0.0,0.0,TS)
      CALL AXIS (0.0,-1.0.12HROLL FIN-DEG,12,2.0,90.0,-10.0,10.0)
      N=NT36/2
      I=1
      DO 320 J=1,NT36,2
      VWH(I)=RFINT(J)
      ZWH(I)=RFINT(J+1)
      I=I+1
```

```
  320 CONTINU
      CALL DASH (UWH,ZWH,N,Z1,Z2,SPA,TS,10.0,LSYMB,XLIM,2.0)
      CALL PLOT (0.0,3.0,-3)
      CALL PLOT (9.0,0.0,2)
      CALL AXIS (0.0,-1.0,11HYAW FIN-DEG,11,2.0,90.0,-10.0,10.0)
      I=1
      DO 330 J=1,NT31,2
      UWH(I)=YFINT(J)
      ZWH(I)=YFINT(J+1)
      I=I+1
  330 CONTINUE
      N=NT31/2
      CALL DASH (UWH,ZWH,N,Z1,Z2,SPA,TS,10.0,LSYMB,XLIM,2.0)
      CALL PLOT (0.0,3.0,-3)
      CALL PLOT (9.0,0.0,2)
      CALL AXIS (0.0,-1.0,13HPITCH FIN-DEG,13,2.0,90.0,-10.0,10.0)
      I=1
      DO 340 J=1,NT26,2
      UWH(I)=PFINT(J)
      ZWH(I)=PFINT(J+1)
      I=I+1
  340 CONTINUE
      N=NT26/2
      CALL DASH (UWH,ZWH,N,Z1,Z2,SPA,TS,10.0,LSYMB,XLIM,2.0)
      CALL SYMBOL (0.5,3.0,0.14,6HFIGURE,0.0,6)
      CALL SYMBOL (0.5,2.7,0.14,IPLOT,0.0,5)
      CALL SYMBOL (1.2,2.7,0.14,35H CONTROL SURFACE DEFLECTION VS TIME,
     1.0,35)
      CALL PLOT (X,-9.0,-3)
      CALL PLOT (0.0,0.0,999)
C  PLOT RATES VS TIME
      CALL PLOTS (5HCAL26,0,4HPLOT)
      CALL PLOT (.5,2.5,-3)
      CALL PLOT (9.0,0.0,2)
      CALL AXIS (0.0,-2.0,TIME,-20,9.0,0.0,0.0,TS)
```

```
      CALL AXIS (0.0,-1.5,12HROLL DEG/SEC,12,3.0,90.0,-3.0,2.0)
      I=1
      DO 350 J=1,NT35,2
      VWH(I)=PHIDT(J)
      ZWH(I)=PHIDT(J+1)
      I=I+1
  350 CONTINUE
      N=NT35/2
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,2.,LSYMB,XLIM,3.5)
      CALL PLOT (0.0,3.5,-3)
      CALL PLOT (9.0,0.0,2)
      CALL AXIS (0.0,-1.5,11HYAW DEG/SEC,11,3.0,90.0,-3.0,2.0)
      I=1
      DO 360 J=1,NT30,2
      VWH(I)=PSIDT(J)
      ZWH(I)=PSIDT(J+1)
      I=I+1
  360 CONTINUE
      N=NT30/2
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,2.,LSYMB,XLIM,3.5)
      CALL PLOT (0.0,3.5,-3)
      CALL PLOT (9.0,0.0,2)
      CALL AXIS (0.0,-1.5,13HPITCH DEG/SEC,13,3.0,90.0,-3.0,2.0)
      I=1
      DO 370 J=1,NT25,2
      VWH(I)=THEDT(J)
      ZWH(I)=THEDT(J+1)
      I=I+1
  370 CONTINUE
      N=NT25/2
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,2.,LSYMB,XLIM,3.5)
      CALL SYMBOL (0.5,2.50,0.14,6HFIGURE,0.0,6)
      CALL SYMBOL (0.5,2.20,0.14,IPLOT,0.0,5)
      CALL SYMBOL (1.2,2.20,0.14,18H FIRST STAGE RATES,0.0,18)
      CALL PLOT (X,-9.5,-3)
```

```
      CALL PLOT (0.0,0.0,999)
C   PLOT ACCELERATION VS TIME
      CALL PLOTS (5HCAL26,0,4HPLOT)
      CALL PLOT (.5,2.5,-3)
      CALL PLOT (9.0,0.0,2)
      CALL AXIS (0.0,-2.0,TIME,-20,9.0,0.0,0.0,TS)
      CALL AXIS (0.0,-1.5,15HROLL DEG/SEC**2,15,3.0,90.0,-3.0,2.0)
      I=1
      DO 380 J=1,NT34,2
      VWH(I)=PHIDDT(J)
      ZWH(I)=PHIDDT(J+1)
      I=I+1
  380 CONTINUE
      N=NT34/2
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,2.,LSYMB,XLIM,3.5)
      CALL PLOT (0.0,3.5,-3)
      CALL PLOT (9.0,0.0,2)
      CALL AXIS (0.0,-1.5,14HYAW DEG/SEC**2,14,3.0,90.0,-3.0,2.0)
      I=1
      DO 390 J=1,NT29,2
      VWH(I)=PSIDDT(J)
      ZWH(I)=PSIDDT(J+1)
      I=I+1
  390 CONTINUE
      N=NT29/2
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,2.,LSYMB,XLIM,3.5)
      CALL PLOT (0.0,3.5,-3)
      CALL PLOT (9.0,0.0,2)
      CALL AXIS (0.0,-1.5,16HPITCH DEG/SEC**2,16,3.0,90.0,-3.0,2.0)
      I=1
      DO 400J=1,NT24,2
      VWH(I)=THEDDT(J)
      ZWH(I)=THEDDT(J+1)
      I=I+1
  400 CONTINUE
```

```
      N=NT24/2
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,2.,LSYMB,XLIM,3.5)
      CALL SYMBOL (0.5,2.50,0.14,6HFIGURE,0.0,6)
      CALL SYMBOL (0.5,2.20,0.14,IPLOT,0.0,5)
      CALL SYMBOL (1.2,2.20,0.14,26H FIRST STAGE ACCELERATIONS,0.0,26)
      CALL PLOT (X,-9.5,-3)
      CALL PLOT (0.0,0.0,999)
C   PLOT ALPHA AND BETA VS TIME
      CALL PLOTS (5HCAL26,0,4HPLOT)
      CALL PLOT (0.5,6.0,-3)
      CALL PLOT (9.0,0.0,2)
      CALL AXIS (0.0,-4.0,24HANGLE OF SIDESLIP,  -DEG,24,8.0,90.0,-8.0,2
     1.0)
      CALL SYMBOL (-.5,-4.4,.07,10HNOSE RIGHT,0.0,10)
      CALL SYMBOL (-.5,4.75,.07,9HNOSE LEFT,0.0,9)
      CALL AXIS (0.0,-4.5,TIME,-20,9.0,0.0,0.0,TS)
      I=1
      DO 410 J=1,NT32,2
      VWH(I)=BETAT(J)
      ZWH(I)=-BETAT(J+1)
      I=I+1
  410 CONTINUE
      N=NT32/2
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,2.,LSYMB,XLIM,4.5)
      CALL SYMBOL (0.5,6.0,0.14,6HFIGURE,0.0,6)
      CALL SYMBOL (0.5,5.7,0.14,IPLOT,0.0,5)
      CALL SYMBOL (1.2,5.7,0.14,26H ANGLE OF SIDESLIP VS TIME,0.0,26)
      CALL PLOT (X,-6.0,-3)
      CALL PLOT (0.0,0.0,999)
      CALL PLOTS (5HCAL26,0,4HPLOT)
      CALL PLOT (0.5,6.0,-3)
      CALL PLOT (9.0,0.0,2)
      CALL AXIS (0.0,-4.0,21HANGLE OF ATTACK,  DEG,22,8.0,90.0,-8.0,2.0)
      CALL SYMBOL (-.5,-4.4,.07,9HNOSE DOWN,0.0,9)
      CALL SYMBOL (-.5,4.75,.07,7HNOSE UP,0.0,7)
```

```
      CALL AXIS (0.0,-4.5,TIME,-20,9.0,0.0,0.0,TS)
      I=1
      DO 420 J=1,NT27,2
      VWH(I)=ALPHAT(J)
      ZWH(I)=ALPHAT(J+1)
      I=I+1
  420 CONTINUE
      N=NT27/2
      CALL DASH (VWH,ZWH,N,Z1,Z2,SPA,TS,2.,LSYMB,XLIM,4.5)
      CALL SYMBOL (0.5,6.0,0.14,6HFIGURE,0.0,6)
      CALL SYMBOL (0.5,5.7,0.14,IPLOT,0.0,5)
      CALL SYMBOL (1.2,5.7,0.14,24H ANGLE OF ATTACK VS TIME,0.0,24)
      CALL PLOT (X,-6.0,-3)
      CALL PLOT (0.0,0.0,999)
  430 RETURN
      END
```

```
*DECK DASH
      SUBROUTINE DASH (X,Y,NP,Z1,Z2,SPACE,XSCALE,YSCALE,LSYMB,XLIM,YLIM)
C     SYMBOLS,DASHED,DASHED-DOT LINES OR SOLID LINES WITH OR WITHOUT
C     SYMBOLS BASED ON A SET OF SEQUENTIAL POINTS GIVEN IN
C     THE INPUT 'X' ABSCISSA ARRAY AND THE 'Y' ORDINATE ARRAY
      DIMENSION X(1),Y(1)
      DO 10 I=1,NP
      XA=X(I)/XSCALE
      YA=Y(I)/YSCALE
      IF (ABS(XA).GT.XLIM) GO TO 10
      IF (ABS(YA).GT.YLIM) GO TO 10
      CALL PLOT (XA,YA,3)
      GO TO 20
   10 CONTINUE
   20 IF (SPACE) 330,310,30
C     THIS SUBROUTINE PLOTS A CALCOMP PLOT WITH A WIDE VARIETY OF
   30 K=0
      PI2=1.5708
      Z=Z1
      ZB=Z2
      IF  Z2 .GT. 0.) GO TO 40
      ZB=Z1
   40 ZD=Z
      LZ=0
      SL=0.
      NF=NP-1
      DO 300 J=1,NF
      XA=X(J)/XSCALE
      IF (ABS(XA)-XLIM .GT. 0.) GO TO 300
      XB=X(J+1)/XSCALE
      IF (ABS(XB)-XLIM .GT. 0.) GO TO 300
      YA=Y(J)/YSCALE
      IF (APS(YA)-YLIM .GT. 0.) GO TO 300
      YB=Y(J+1)/YSCALE
```

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```
      IF (ABS(YB)-YLIM .GT. 0.) GO TO 300
      DY=YB-YA
      DX=XB-XA
      IF (DX .NE. 0.) GO TO 80
      IF (DY) 50,60,70
   50 TH=-PI2
      GO TO 90
   60 TH=0.
      GO TO 90
   70 TH=PI2
      GO TO 90
   80 TH=ATAN(DY/DX)
   90 DX=XB-XA
      DY=YB-YA
      DZ=SQRT(DX*DX+DY*DY)
C    TEST TO SEE WHAT IS GOING ON
      IF (K) 100,180,220
  100 K=1
      SL=SPACE
      IF (DZ-SPACE) 110,120,150
C    SPACE IS LARGER THAN DZ
  110 SL=SL-DZ
      CALL PLOT (XB,YB,3)
      GO TO 300
C    NEXT POINT IS EXACTLY ONE SPACE
  120 K=0
      IF (LZ .NE. 0 ) GO TO 130
      ZD=ZB
      LZ=1
      GO TO 140
  130 ZD=Z
      LZ=0
  140 SL=0.
      CALL PLOT (XB,YB,3)
```

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```
      GO TO 300
C   NEXT POINT MORE THAN ONE SPACE AWAY
  150 XA=XA+SPACE*COS(TH)
      YA=YA+SPACE*SIN(TH)
      IF (ABS(XA)-XLIM .GE. 0.) GO TO 300
      IF (ABS(YA)-YLIM .GE. 0.) GO TO 300
      K=0
      IF (LZ .NE. 0 ) GO TO 160
      ZD=ZB
      LZ=1
      GO TO 170
  160 ZD=Z
      LZ=0
  170 SL=0.
      CALL PLOT (XA,YA,3)
      GO TO 90
C  K=0 LINE BEING DRAWN ZD LENGTH NOT DRAWN RESUME AS IS LINE STARTING
  180 IF (DZ-ZD) 190,200,210
C   LINE GOES AT LEAST TO NEXT POINT
  190 K=0
      ZD=ZD-DZ
      CALL PLOT (XB,YB,2)
      GO TO 300
C   LINE ENDS AT NEXT POINT
  200 K=-1
      SL=SPACE
      ZD=0.
      CALL PLOT (XB,YB,2)
      GO TO 300
C   LINE ENDS BEFORE NEXT POINT
  210 K=1
      SL=SPACE
      XA=XA+ZD*COS(TH)
      YA=YA+ZD*SIN(TH)
```

```
      IF (ABS(XA)-XLIM .GE. 0.) GO TO 300
      IF (ABS(YA)-YLIM .GE. 0.) GO TO 300
      CALL PLOT (XA,YA,2)
      ZD=0.
      GO TO 90
C   K=1 IS IN SPACE
  220 ZD=0.
      IF (DZ-SL) 230,240,270
  230 K=1
      SL=SL-DZ
      CALL PLOT (XB,YB,3)
      GO TO 300
C  SL=DZ
  240 K=0
      IF (LZ .NE. 0 ) GO TO 250
      ZD=ZB
      LZ=1
      GO TO 260
  250 ZD=Z
      LZ=0
  260 CALL PLOT (XB,YB,3)
      GO TO 300
C   SL IS LESS THAN DZ
  270 K=0
      IF (LZ .NE. 0 ) GO TO 280
      ZD=ZB
      LZ=1
      GO TO 290
  280 ZD=Z
      LZ=0
  290 XA=XA+SL*COS(TH)
      YA=YA+SL*SIN(TH)
      IF (ABS(XA)-XLIM .GE. 0.) GO TO 300
      IF (ABS(YA)-YLIM .GE. 0.) GO TO 300
```

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```
      SL=0.
      CALL PLOT (XA,YA,3)
      GO TO 90
  300 CONTINUE
      GO TO 370
C   STRAIGHT LINE PLOT OPTION
  310 DO 320 J=I,NP
      XA=X(J)/XSCALE
      YA=Y(J)/YSCALE
      IF (ABS(XA)-XLIM .GT. 0.) GO TO 320
      IF (ABS(YA)-YLIM .GT. 0.) GO TO 320
      CALL PLOT (XA,YA,2)
  320 CONTINUE
      GO TO 370
C   PLOT SYMBOLS ON LINE  NO LINE IF LYSMB IS NEGATIVE
  330 NSM=IABS(LSYMB)
      IF (LSYMB .LT. 0 ) GO TO 340
      K=-2
      GO TO 350
  340 K=-1
  350 DO 360 J=1,NP
      XA=X(J)/XSCALE
      YA=Y(J)/YSCALE
      IF (ABS(XA)-XLIM .GT. 0.) GO TO 360
      IF (ABS(YA)-YLIM .GT. 0.) GO TO 360
      CALL SYMBOL (XA,YA,0.07,NSM,0.0,K)
  360 CONTINUE
  370 CALL PLOT (0.,0.,3)
      RETURN
      END
```

```
*DECK DTBLN
      SUBROUTINE DTBLN (ORD,ABSC1,ABSC2,N1,TAB1,N2,TAB2,TORD,M1,M2)
C     THIS IS A DOUBLE TABLE LOOKUP SUBROUTINE.
C       ORD   =THE RETURNED ORDINATE
C       ABSC2=THE SECOND VARIABLE ABSCISSA INPUT
C       N1    =NUMBER VALUES IN TABLE OF ABSCISSA1 TABLE
C       TAB1  =FIRST VARIABLE TABLE OF ABSCISSA VALUES
C       N2    =NUMBER OF SECOND VARIABLE ABSCISSA TABLE VALUES
C       TAB2  =SECOND VARIABLE TABLE OF ABSCISSA VALUES
C       TORD  =TABLE OF ORDINATE VALUES
C       M1,M2=TABLE LOOKUP INDICES OF CURRENT SEARCH
      DIMENSION TAB1(5),TAB2(50),TORD(5,50),Y1(50)
C     FIRST TEST ABSC1 RELATIVE TO M1 INDEX
   10 IF (ABSC1-TAB1(M1)) 20,40,50
C     ABSC1 IS LOWER IN TABLE; DOWNSTEP
   20 M1=M1-1
C     TEST FOR LOWER LIMIT OF TABLE
      IF (M1.LE.0) GO TO 30
      GO TO 10
   30 M1=1
   40 X1=0.
      GO TO 90
C     ABSC1 IS GREATER THAN TAB1(M1)
   50 M1=M1+1
      IF (M1.GT.N1) GO TO 80
      IF (ABSC1-TAB1(M1)) 60,70,50
C     LOCATED RANGE, NOW INTERPOLATE TO GET FACTOR X1
   60 X1=(ABSC1-TAB1(M1-1))/(TAB1(M1)-TAB1(M1-1))
      M1=M1-1
      GO TO 90
   70 X1=0.
      GO TO 90
   80 M1=M1-1
      X1=0.
```

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```
      GO TO 90
C     DO SINGLE TABLE LOOKUP AT LOWER RANGE
   90 DO 100 J=1,N2
  100 Y1(J)=TORD(M1,J)
      CALL TBLN (ORD,ABSC2,TAB2,Y1,N2,M2)
C     TEST X1 TO SEE IF SECOND LOOKUP IS NECESSARY
      IF (X1.EQ.0.) RETURN
C     SET UP FOR NEXT HIGHER RANGE TABLE LOOKUP
      M11=M1+1
      DO 110 J=1,N2
  110 Y1(J)=TORD(M11,J)
      CALL TBLN (ORD2,ABSC2,TAB2,Y1,N2,M2)
C     INTERPOLATE BETWEEN VALUES BASED ON X1 VALUE
      ORD=ORD+X1*(ORD2-ORD)
      RETURN
      END
```

```
*DECK MAXA
      FUNCTION MAXA (N,A)
      DIMENSION A(1)
      X=ABS(A(1))
      DO 10 J=2,N
      Y=ABS(A(J))
      IF (Y-X .LE. 0.) GO TO 10
      X=Y
   10 CONTINUE
      MAXA=X
      RETURN
      END
```

```
*DECK PAGEHD
      SUBROUTINE PAGEHD
C     THIS SUBROUTINE EJECTS A PAGE AND PRINTS RUN NO. AND PAGE NO.
      COMMON/P2/ Q,NERR1,NERR2,NRUN,NPAGE,PVAR(180,24),YVAR(180,24),
     1   RVAR(180,9),WIND(180,9),FTIT(8)
      WRITE( 6,10)
      WRITE( 6,20) NRUN,NPAGE
      RETURN
   10 FORMAT (1H1)
   20 FORMAT (1H ,5X,7HRUN NO.,I5,49X,8HPAGE NO.,I5)
      END
```

```
*DECK PLS
      SUBROUTINE PLS (M,X,Y,N,C,NER)
C     THIS IS A LEAST SQUARES POLYNOMIAL CURVE FIT SUBROUTINE.
C          M    = NUMBER OF POINTS GIVEN
C          X    = ABSCISSA VALUES
C          Y    = CORRESPONDING ORDINATE VALUES
C          N    = THE ORDER OF THE POLYNOMIAL
C          C    = THE RETURNED POLYNOMIAL COEFFICIENTS I.E.
C                 Y=C(1)+C(2)*X+C(3)*X**2+C(4)*X**3+.......
C          NER  = ERROR CODE. NER=0 ABNORMAL; NER=1 NORMAL
      DIMENSION X(20),Y(20),C(11),D(10),B(11),A(10,10)
      NER=1
      NP=N+1
      N2=2*N
      DO 10 J=1,NP
      B(J)=0.
      DO 10 K=1,NP
   10 A(J,K)=0.
      A(1,1)=M
      DO 30 J=1,M
      B(1)=B(1)+Y(J)
      DO 30 K=2,NP
      IF (X(J) .NE. 0.) GO TO 20
      B(K)=B(K)
      GO TO 30
   20 B(K)=B(K)+Y(J)*X(J)**(K-1)
   30 CONTINUE
      DO 40 J=1,N2
   40 D(J)=0.
      DO 60 K=1,M
      DO 60 J=1,N2
      IF (X(K) .NE. 0.) GO TO 50
      D(J)=D(J)
      GO TO 60
```

```
50 D(J)=D(J)+X(K)**J
60 CONTINUE
   DO 70 J=2,NP
   DO 70 K=1,NP
   JK=J+K-2
   A(J,K)=D(JK)
70 A(K,J)=A(J,K)
   CALL SIMEQ (A,B,NP,C,NER)
   RETURN
   END
```

```
*DECK PUNAID
      SUBROUTINE PUNAID (J,N)
C     THIS SUBROUTINE SETS UP AND PREPARES THE PUNCHED CARD OUTPUT FILE
C     DATA TO BE PUNCHED IS TRANSFERRED IN COMMON BLOCK 'PUNSH'
      COMMON /PUNSH/PUNCH(6,200),NTITL(6),NNTITL(6),NAME(6)
      WRITE( 7,90) NTITL(J),NNTITL(J)
      NI=1
   10 NDEL=N-NI+1
      NF=NI+NDEL
      NF2=NI+5
      IF (NDEL-6) 20,40,50
   20 DO 30 K=NF,NF2
   30 PUNCH(J,K)=0.
   40 WRITE( 7,100) (NAME(J),(PUNCH(J,K),K=NI,NF2))
      RETURN
   50 WRITE( 7,100) (NAME(J),(PUNCH(J,K),K=NI,NF2))
      NLR=NDEL/6-1
      IF (NLR-4 .LT. 0 ) GO TO 60
      NF2=NI+29
      NST=NI+6
      WRITE( 7,110) (PUNCH(J,K),K=NST,NF2)
      IF (NF2.EQ.N) RETURN
      NI=NF2-1
      GO TO 10
   60 NST=NI+6
      NODD=N-NI-5-6*NLR
      M2=N
      IF (NODD.EQ.0) GO TO 80
      M1=N+1
      M2=N+6-NODD
      DO 70 K=M1,M2
   70 PUNCH(J,K)=0.
   80 WRITE( 7,110) (P     (J,K),K=NST,M2)
      RETURN
   90 FORMAT (5X,2H$$,3X,2A8)
  100 FORMAT (A8,2X,6(F10.3,1H,),2H$$)
  110 FORMAT ((10X,6(F10.3,1H,)),2H$$)
      END
```

```
*DECK SIMEQ
      SUBROUTINE SIMEQ (A,XDOT,KC,X,IERR)
      DIMENSION A(10,10),B(10,10),XDOT(11),X(11),AINV(10,10)
C    THIS SUBROUTINE FINDS THE INVERSE OF THE MATRIX A USING DIAGONALIZAT
C    PROCEDURES
      N=1
      .ERR=1
      DO 10 I=1,KC
      DO 10 J=1,KC
      AINV(I,J)=0.
   10 B(I,J)=A(I,J)
      DO 20 I=1,KC
      AINV(I,I)=1.
   20 X(I)=XDOT(I)
      DO 110 I=1,KC
      COMP=0.
      K=I
   30 IF (ABS(B(K,I))-ABS(COMP) .LE. 0.) GO TO 40
      COMP=B(K,I)
      N=K
   40 K=K+1
      IF (K-KC .LE. 0 ) GO TO 30
      IF (B(N,I) .EQ. 0.) GO TO 120
      IF (N-I) 120,70,50
   50 DO 60 M=1,KC
      TEMP=B(I,M)
      B(I,M)=B(N,M)
      B(N,M)=TEMP
      TEMP=AINV(I,M)
      AINV(I,M)=AINV(N,M)
   60 AINV(N,M)=TEMP
      TEMP=X(I)
      X(I)=X(N)
      X(N)=TEMP
```

```
   70 X(I)=X(I)/B(I,I)
      TEMP=B(I,I)
      DO 80 M=1,KC
      AINV(I,M)=AINV(I,M)/TEMP
   80 B(I,M)=B(I,M)/TEMP
      DO 100 J=1,KC
      IF (J-I .EQ. 0 ) GO TO 100
      IF (B(J,I) .EQ. 0.) GO TO 100
      X(J)=X(J)-B(J,I)*X(I)
      TEMP=B(J,I)
      DO 90 N=1,KC
      AINV(J,N)=AINV(J,N)-TEMP*AINV(I,N)
   90 B(J,N)=B(J,N)-TEMP*B(I,N)
  100 CONTINUE
  110 CONTINUE
      RETURN
  120 WRITE( 6,130)
      IERR=0
      RETURN
  130 FORMAT (6X,22HTHE MATRIX IS SINGULAR)
      END
```

```
*DECK SMDF
      SUBROUTINE SMDF (NT,T,TM,NP,NOR,TD)
C     THIS SUBROUTINE COMPUTES THE DERIVATIVE OF A CURVE USEING
C     A LEAST SQUARES POLYNOMIAL CURVE FIT OF A LOCAL NUMBER OF
C     POINTS ON THE CURVE.
C          NT=NUMBER OF POINTS IN INPUT TABLE 'T' WHICH IS ALTERNATING
C             ALTERNATING VALUES OF ABSCISSAS AND ORDINATES
C          TM=IS THE ABSCISSA VALUE AT WHICH THE DERIVATIVE IS
C             DESIRED
C          NP=IS THE NUMBER OF LOCAL POINTS TO BE USED IN THE FIT
C         NOR=IS THE ORDER OF THE POLYNOMIAL TO BE USED
C          TD=IS THE DERIVATIVE TO BE RETURNED
      DIMENSION X(20),Y(20),A(11),T(500)
      I=NOR+1
      L=2*NP
      LB=2*(NP/2)+1
      M=NP/2
      IF (NP+1-NOR .GE. 0 ) GO TO 20
   10 TD=0.
      GO TO 140
   20 IF (TM-T(LB) .GT. 0.) GO TO 50
      IF (NT-L .LT. 0 ) GO TO 10
      DO 30 J=1,NP
      K=2*J-1
      X(J)=T(K)
   30 Y(J)=T(K+1)
      IF (TM-X(1) .NE. 0.) GO TO 40
      DT=0.
      GO TO 120
   40 DT=TM-X(1)
      GO TO 120
   50 DO 60 J=1,NT,2
      IF (T(J)-TM .GE. 0.) GO TO 70
   60 CONTINUE
```

```
   70 NC=J
      MP=NC-2*M
      IF (NT-MP-L+1 .GE. 0 ) GO TO 80
      MP=NT-L+1
   80 IF (TM-T(MP) .NE. 0.) GO TO 90
      DT=0.
      GO TO 100
   90 DT=TM-T(MP)
  100 X(1)=0.
      Y(1)=T(MP+1)
      DO 110 J=2,NP
      JX=MP+2*(J-1)
      X(J)=T(JX)-T(MP)
  110 Y(J)=T(JX+1)
C     COMPUTE LEAST SQUARES POLYNOMIAL OF Y VERSUS X
  120 CALL PLS (NP,X,Y,NOR,A,NER)
      IF (NER .EQ. 0 ) GO TO 10
C     COMPUTE DERIVATIVE OF Y W.R.T. X AT X=DT
      TD=A(2)
      IF (DT .EQ. 0.) GO TO 140
      DO 130 J=3,I
      XT=J-1
  130 TD=TD+XT*A(J)*DT**(J-2)
  140 RETURN
      END
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
*DECK TBLN
      SUBROUTINE TBLN (Y,X,T,A,NT,M)
C     THIS  SUBROUTINE IS A TABLE LOOKUP FROM ABSCISSA TABLE 'T'
C     AND ORDINATE TABLE'A'. 'Y' IS ORDINATE AT GIVEN ABSCISSA 'X'.
C     'NT' IS LENGTH OF TABLES'T'AND'A'. 'M' IS LOCATION OF LAST VALUE
      DIMENSION T(1),A(1)
   10 IF (T(M)-X) 50,20,30
   20 Y=A(M)
      RETURN
   30 IF (T(1)-X.LT.0.) GO TO 40
      M=1
      GO TO 20
   40 M=M-1
      GO TO 10
   50 MM=M+1
      IF (MM-NT.LE.0) GO TO 60
      M=NT
      GO TO 20
   60 IF (T(MM)-X.GT.0.) GO TO 70
      M=MM
      GO TO 50
   70 M=MM-1
      DT=T(MM)-T(M)
      IF (DT.NE.0.) GO TO 80
      Y=A(M)
      RETURN
   80 DY=A(MM)-A(M)
      DDT=X-T(M)
      Y=A(M)+DY*DDT/DT
      RETURN
      END
```

```
*DECK TBLU
      SUBROUTINE TBLU (NT,Y,X,T,M)
C     SINGLE TABLE LOOKUP SUBROUTINE
C        NT = NUMBER OF VALUES IN ARRAY
C        Y  = RETURNED ORDINATE
C        X  = ABSCISSA VALUE CALLED
C        T  = INPUT TABLE OF ALTERNATING ABSCISSAS AND ORDINATES
C             ORDINATES MUST BE MONOTONICALLY INCREASING
C        M  = PREVIOUS INDEX USED IN THIS TABLE LOOKUP
C             THIS INDEX GETS CHANGED TO CURRENT VALUE
      DIMENSION T(1)
   10 IF (T(M)-X) 50,20,30
   20 Y=T(M+1)
      RETURN
   30 IF (T(1)-X.LT.0.) GO TO 40
      M=1
      GO TO 20
   40 M=M-2
      GO TO 10
   50 MM=M+2
      IF (MM-NT-1.LE.0) GO TO 60
      M=NT-1
      GO TO 20
   60 IF (T(MM)-X.GT.0.) GO TO 70
      M=MM
      GO TO 50
   70 M=MM-2
      DT=T(MM)-T(M)
      IF (DT.NE.0.) GO TO 80
      Y=T(M+1)
      RETURN
   80 DY=T(MM+1)-T(M+1)
      DDT=X-T(M)
      Y=T(M+1)+DY*DDT/DT
      RETURN
      END
```